TM 11-5821-203-35

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

FIELD AND DEPOT MAINTENANCE

RADIO TRANSMITTING SET AN/ART-34

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HEADQUARTERS, DEPARTMENT OF THE ARMY
17 JUNE 1960

WARNING

DANGEROUS VOLTAGES ARE PRESENT IN THIS EQUIPMENT

Voltages as high as 375 volts are present in this equipment. All testing should be done with proper regard for the danger involved. All repairs or tube replacements should be made with the primary power disconnected.

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TECHNICAL MANUAL

No. 11–5821–203–35

HEADQUARTERS,
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WASHINGTON 25, D. C., *17 June 1960*

RADIO TRANSMITTING SET AN/ART–34

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wire shielding for fraying, crimping, and corrosion.

(8) Check connector plug exteriors for corrosion, cracks, overheating, and loose wire connections.

(9) Check the condition of the transmitter and control unit panels and knobs for looseness or binding, and check cabling where accessible.

(10) Check the safety wiring of the transmitter, mounting, and antenna.

(11) Check for foreign objects in the vicinity of the transmitter. Use a portable vacuum cleaner where necessary. Moisten a clean, soft, damp cloth with cleaning compound and wipe dust off the transmitter and the control unit.

b. The following tests should be made with *power on* (par. 9 through 13):

(1) Check the transmitter front-panel glow lamps. The lamps should glow when the Autopositioner[1] motors operate.

(2) Check the control unit panel lamps. These should light when the equipment is turned on, and may be adjustable, depending on the unit aircraft in which the equipment is installed.

(3) Check for proper operation of the Autopositioner on at least two settings of the control unit.

(4) Check the power output with a wattmeter or the transmitter meter readings.

(5) Adjust the sidetone for suitable level in the headset.

(6) Check the modulation and overall operation by contact with another station.

4. Internal Preventive Maintenance Procedures

Check the following items when the transmitter is moved (par. 8) from the aircraft for the pullout check:

a. Inspect the seating of readily accessible pluckout items: tubes, lamps, crystals.

b. Inspect the relays for loose mountings, bad contacts, misalignment of contacts and springs, proper spring tension.

c. Inspect variable capacitors for dirt, misalignment of plates, loose mountings, moisture.

d. Inspect the resistors, bushings, and insulators for cracks, chipping, blistering, moisture, and discoloration.

e. Clean and tighten the switches, terminal blocks, relay cases, and interiors of chassis and cabinet.

f. Inspect the terminal blocks for loose connections, cracks, and breaks.

g. Inspect the terminals of the large fixed capacitors and resistors for dirt, corrosion, and loose contacts.

h. Inspect the transformers, chokes, potentiometers, and rheostats for overheating and oil leakage.

i. Check the dynamotor brushes for cracks, and cleanliness; the armature and commutator for cleanliness; the bearings for cleanliness, wear, and adequate lubrication.

j. Check the Autopositioner motor brushes for cracks, cleanliness, and wear; the commutator for cleanliness.

k. Check for normal operation. (This check requires the use of Electronic Equipment Maintenance Kit MK–430/ART.) Refer to paragraphs 42 through 50.

5. Lubrication

Lubrication of the transmitter and control unit is necessary at 6-month intervals and requires disassembly of the equipment. Information concerning lubrication will be found in paragraph 74.

6. Overload Protection

The transmitting set contains no fuses. Overload protection is furnished by circuit breakers. During installation, a 20-ampere circuit breaker is connected into the aircraft powerline to the transmitter. The dynamotor assembly is protected by a thermal overload switch which opens the motor circuit if the dynamotor overheats. Since all dynamotors may not contain the thermal overload switch, observe cautions throughout the text.

7. Cabling

Cabling requirements vary with the type of aircraft used. Figure 1 shows a typical cabling diagram of the transmitter when it is used in conjunction with a receiver which is part of

[1] Registered in U. S. Patent Office.

Radio Set A.R.C. Type 12. During installation, cables are fabricated to connect the microphone control switches, primary power, and Frequency Selector Control C–1915/AR to mounting jack J504. This 30-pin female connector engages with male connector P504 on the transmitter when the transmitter is in place. Twelve wires connect the control unit to jack J504. Primary power (27.5 volts dc) is routed through the circuit breaker panel to pins A2, 2, and 27, on J504. Pin 1 is the return or ground lead. The microphone control, sidetone, receiver disabling, and muting circuits are wired through an auxiliary radio junction box, to the foot switches, the headset, Oscillator Relay Unit 0–423/AR, and the A.R.C. Type 12 Control Unit C–56, respectively. RCVR jack J601 is connected with a coaxial cable to one of the receivers used in the A.R.C. Type 12 configuration. ANT jack J602 is coupled with the coaxial cable to Antenna AT–700/AR through Oscillator Relay Unit 0–423/AR and a radiofrequency (rf) load unit. The oscillator relay unit and rf load unit are not part of Radio Transmitting Set AN/ART–34.

8. Removal and Replacement of Radio Transmitter T-595/AR

Before removing the transmitter from the aircraft, tune the transmitter to 118.0 mc.

a. To remove the transmitter:

(1) Disconnect the two rf cables from the front panel of the transmitter and tag the cables.

(2) With a pair of diagonal pliers, remove the safety wire from the hold-down clamps (fig. 4, TM 11–5821–203–12).

(3) Loosen and disengage the holddown clamps.

(4) Turn the extractor mechanism thumbscrew counterclockwise.

(5) Lift the transmitter away from the extractor slot and pull forward.

b. To replace the transmitter, proceed as follows:

(1) Turn the extractor mechanism by rotating the thumbscrew as far as possible in a counterclockwise direction.

(2) Place the transmitter on the shock mount and push toward the rear so that the front panel drops into the extractor slot.

(3) Rotate the extractor mechanism thumbscrew clockwise until the rear connectors are fully engaged and the holddown clamps can be engaged.

(4) Engage, tighten, and safety-wire the holddown clamps.

(5) Connect the two rf cables to the front panel of the transmitter.

Section II. FUNCTIONAL PERIODIC INSPECTION

9. Power and Test Equipment Requirements

a. The functional checks require the use of an auxiliary power unit, capable of supplying 12.2 amperes at 27.5 volts dc. Coordinate the connecting and disconnecting of the auxiliary power unit to the aircraft with the organizational maintenance repairman or the aircraft crew chief.

b. The test equipment for the operational checks should include a multimeter, such as the Multimeter TS–352B/U, or equivalent and a wattmeter, such as RF Wattmeter AN/URM–43A.

10. Control Unit Operational Check

a. Connect the auxiliary power unit to the aircraft.

b. Turn on the transmitter and allow about 2 minutes to warm up.

c. Remove the front cover from the transmitter.

d. Set the control unit to a reading of 118.0 megacycles (mc).

e. Observe the reading on the transmitter front panel frequency indicators after the tuning cycle is completed. The megacycle and 0.05-megacycle numbers are separated, each group behind its respective relay, K602 and K603 (fig. 2).

f. Repeat step *e* above for each megacycle and 0.05-megacycle step.

11. Power Output Check

a. The transmitter power output can be checked accurately with a wattmeter (RF Wattmeter AN/URM–43A) or roughly checked with meter M601 located on the transmitter

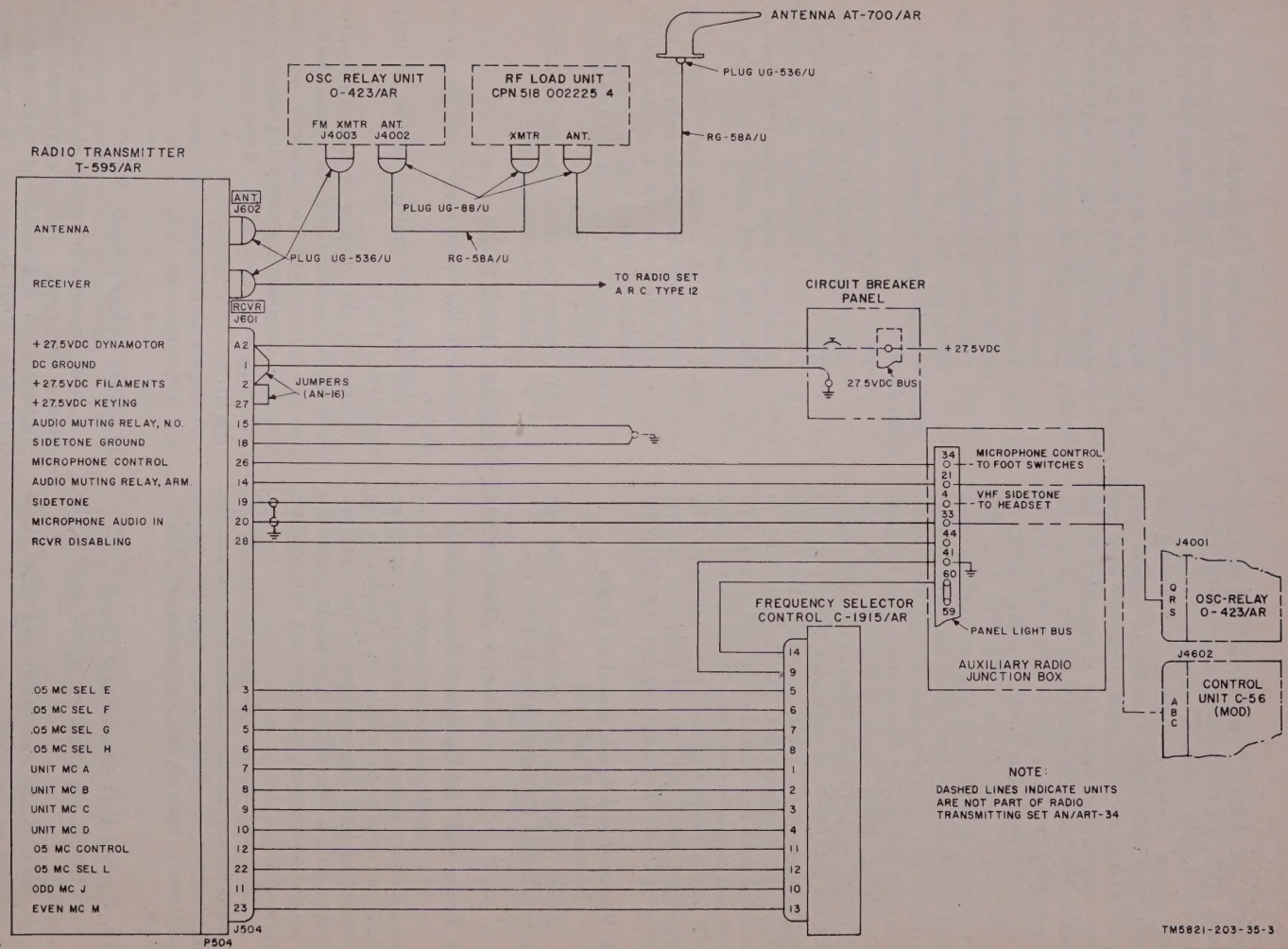

Figure 1. Radio Transmitting Set AN/ART-34, typical cabling diagram.

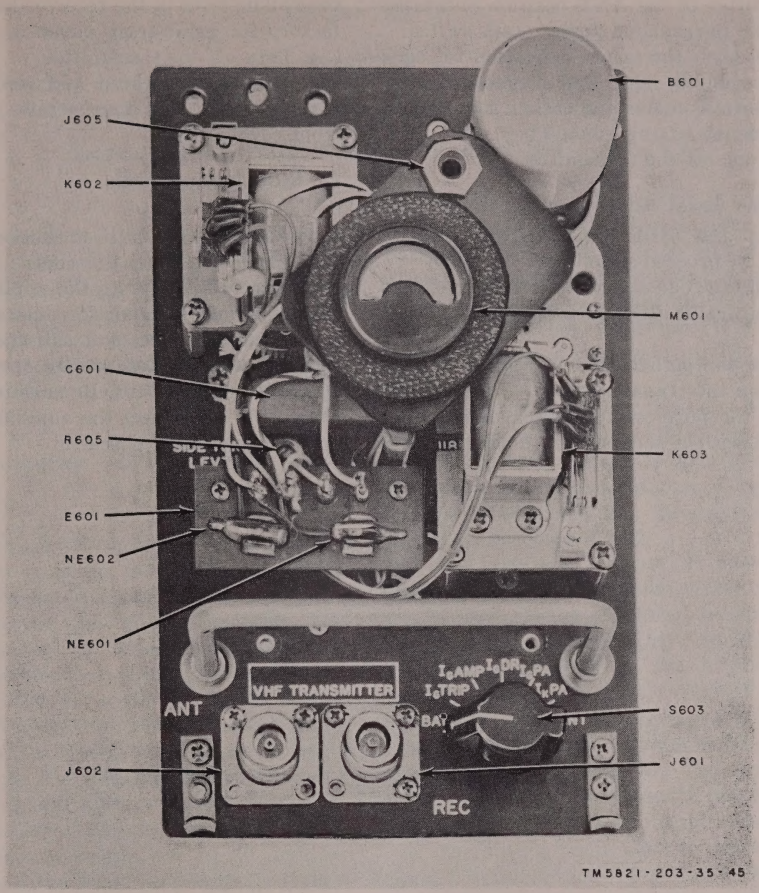

Figure 2. Radio Transmitter T-595/AR, front panel, front cover removed.

front panel (fig. 2). To check the output with the wattmeter, follow the procedure in *b* below. To check the output with the front panel meter, follow the procedure in *c* below.

b. To check the transmitter output with RF Wattmeter AN/URM–43A, proceed as follows:

(1) Turn off the transmitter.
(2) Disconnect the antenna cable from the ANT connector on the transmitter.
(3) Connect the wattmeter to the ANT connector on the transmitter.
(4) Turn on the transmitter and allow two minutes to warm up.
(5) Operate the aircraft push-to-talk switch.
(6) Observe the reading on the wattmeter for all megacycle and 0.05-megacycle frequency settings. Normal minimum power output for all frequencies should be 25 watts.
(7) Turn off the transmitter.
(8) Disconnect the rf wattmeter.
(9) Connect the antenna cable to the ANT connector on the transmitter.

c. To check the output with the transmitter front panel meter, proceed as follows:

Caution: **Use only authorized frequencies.**

(1) Turn on the transmitter.
(2) Set the meter switch knob S603, on the front panel (fig. 2) of the trans-

mitter to the ANT position and press the microphone push-to-talk switch.

(3) Observe the meter indication for each megacycle and 0.05-megacycle step. Normal meter indication for all frequency settings should be 6.

(4) Turn off the transmitter.

12. Sidetone Level Adjustment

To adjust the SIDETONE LEVEL control (R605, fig. 2) proceed as follows:

a. Loosen the four screws that hold the front cover to the transmitter, and remove the front cover.

b. Loosen the potentiometer locknut.

c. Turn on the transmitter.

d. Press the push-to-talk switch, and adjust the control with a screwdriver until the sidetone audio level in the receiver headset is satisfactory for monitoring purposes.

e. Turn off the transmitter.

f. Relock the locknut and replace the front cover. Tighten the four screws that hold the front cover.

13. Modulation Check

The modulation is best checked by actually communicating with the control tower or another aircraft. Refer to the applicable aircraft configuration manual for operating instructions. The presence of a satisfactory sidetone signal also indicates proper operation of the transmitter modulator. Be sure to turn off the power and disconnect the auxiliary power unit upon completion of check.

CHAPTER 2

THEORY

Section I. THEORY OF RADIO TRANSMITTER T–595/AR

14. General

The transmitter employs two banks of crystals and a frequency addition and multiplication system to produce 360 voice channels spaced at 0.05-mc intervals in the 118.0- to 135.95-mc range. The block diagram of the transmitter is discussed in paragraph 15. For complete circuit details, refer to the overall schematic diagram (fig. 66).

15. Radio Transmitter T–595/AR, Block Diagram (fig. 3)

a. The transmitter contains two oscillators whose outputs combine to furnish the basic frequency before multiplication. Oscillator V101 has a frequency of 3.08700 to 3.19255 mc. The oscillator frequency is varied by operation of the 0.05-mc control located on the control unit. This control, when varied to change the output frequency of the transmitter in increments of 0.05-mc, activates the Autopositioner circuit (referred to as the 0.05-mc, Autopositioner) which drives crystal selector switch S101 (fig. 66). Crystal selector switch S101 is part of a seeking circuit and selects one of 20 crystals that determines the basic oscillator frequency (refer to chart in paragraph 80*h*). The basic oscillator frequency, when changed and multiplied nine times (by triplers V303 and V401), corresponds to changes in transmitter frequency in increments of approximately 0.05-mc. Therefore, throughout the text, tube V101 is referred to as the 0.05-mc oscillator.

b. Oscillator V201 has a frequency range of 10.02411 to 11.91300 mc. The oscillator frequency is varied by the operation of the 1-mc control located on the control unit. This control, when varied to change the output frequency of the transmitter in increments of 1-mc, activates the Autopositioner circuit (referred to as the 1-mc Autopositioner), which drives crystal selector switch S201 (fig. 66). Crystal selector switch S201 is part of another seeking circuit and selects one of 18 crystals that determines the basic oscillator frequency (refer to chart in paragraph 80*i*). The basic oscillator frequency, when changed and multiplied nine times, corresponds to changes in transmitter frequency in increments of 1-mc. Therefore, throughout the text, tube V201 is referred to as the 1-mc oscillator.

c. The Autopositioner circuits are used to drive switches S101 and S201 (fig. 66), which select the proper crystals to operate at a desired frequency. The Autopositioner circuits are activated by the 0.05- and the 1-mc controls located on the control unit.

d. The combined outputs of tubes V101 and V201 are fed to the 13-mc mixer tube V301, which produces an amplified output signal in frequency range of 13.11111 to 15.10555 mc. The output signal from the mixer is passed through four capacitively coupled tuned circuits to the grid of 13-mc amplifier tube V302. Amplifier tube V302 is referred to as the 13-mc amplifier, although the frequency of the plate tank circuit is varied from 13.11111 to 15.10555 mc by the 1-mc Autopositioner.

e. The output from V302 is multiplied three times by first tripler V303 and three times by second tripler V401, producing a signal in the frequency range of 118.0 to 135.95 mc. This resulting signal is amplified by rf preamplifier V402. The output of V402 is divided to provide the proper signal inputs for rf drivers V403 and V404, which are used to provide excitation voltage for push-pull final power amplifier V405. The rf output is applied through harmonic filter 35E2 and the contacts on antenna change over relay K601 to the antenna. Antenna change over relay K601 is also connected to the receiver used with the transmitter.

f. Voice signals from the microphone input to the grid of audio preamplifier V501A are amplified and fed to modulator driver V502, which furnishes the excitation voltage for push-pull modulators V503 and V504. The modulating

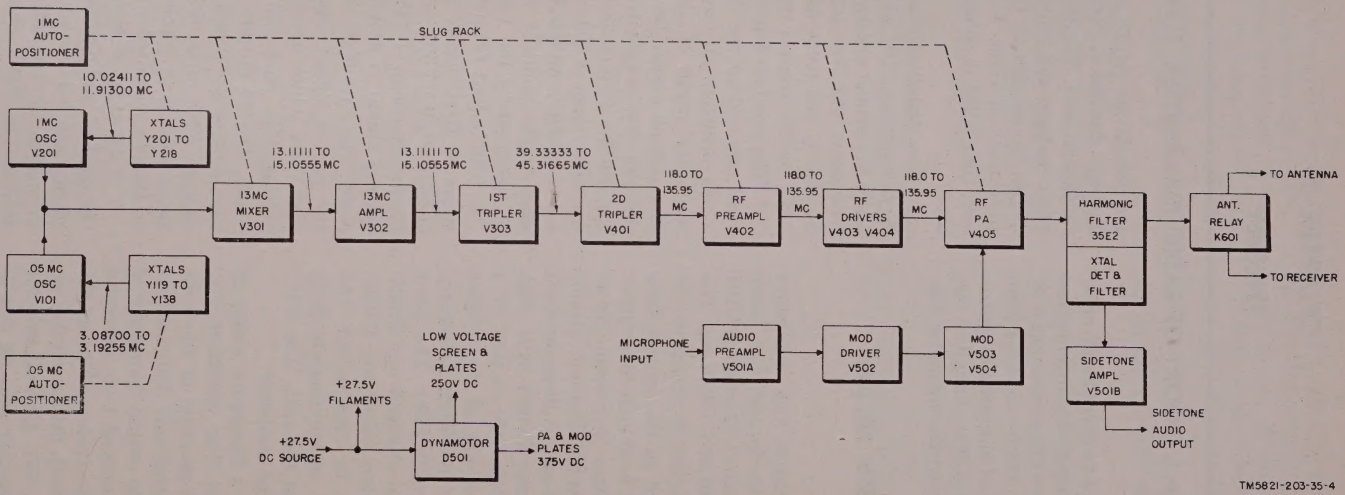

Figure 3. Radio Transmitter T–595/AR, block diagram.

voltage thus produced is used to modulate the plate and screen of push-pull final power amplifier tube V405.

g. Sidetone audio is produced by rectifying a portion of the rf output signal and amplifying it through sidetone amplifier V501B.

h. Dynamotor D501 provides plate and screen voltages for the transmitter tubes. Filament voltage is supplied directly from the 27.5-volt dc aircraft power supply. The power amplifier and modulator 375-volt dc plate voltage is supplied by dynamotor D501. The dynamotor also supplies 250 volts dc to the screens and plates of the other tubes in the transmitter.

16. Oscillator V101
(fig. 4)

a. The 0.05-mc oscillator, V101, is an electron-coupled crystal oscillator employing one of 20 crystals (Y119 through Y138) in the frequency range of 3.08700 to 3.19255 mc. (Refer to the chart in paragraph 80*h*.) The crystals are mounted in a crystal holder board and are selected by switch S101, which is operated by the 0.05 mc Autopositioner unit. Variable capacitor C101 is adjusted so that the total capacitance from grid to ground is 32 micromicrofarad (uuf). This adjustment is made at the factory and should not require further adjustment unless major changes are made in oscillator circuitry; and then it should be attempted only if accurate test equipment is available.

b. The positive feedback circuit in this oscillator is similar to that of a modified Colpitts oscillator. The frequency of oscillation is determined by the resonant frequency of the crystal. The ratio of capacitors C102 and C103 determines the proper amount of feedback necessary to sustain oscillations. Combination bias is used in this oscillator. Grid leak bias is developed across resistor R101, and cathode bias is developed across R102 as a protective bias. Coil L101 offers a high impedance in the cathode circuit and prevents resistor R102 from affecting the ratio of capacitors C102 and C103. The screen grid is placed at ground potential for rf by capacitor C104.

c. B+ voltage is applied to both the plate and screen grids through voltage-dropping resistor R515 and rf choke L106. B+ voltage is applied to the screen grid through voltage-dropping resistor R103, and to the plate through plate resistors R104 and R105. Decoupling is provided by capacitors C111, C112, and C113.

d. The value of resistor R104 in comparison with R105 determines the amount of output signal voltage that is coupled to the filters through capacitor C105. The harmonics of the oscillator are prevented from reaching the mixer grid by two filter combinations. Capacitors C106 and C107 and coils L103 and L104 make up a low-pass filter. Capacitor C108 and coil L105 resonate at 6 mc and offer high impedance to the second harmonic of the crystal.

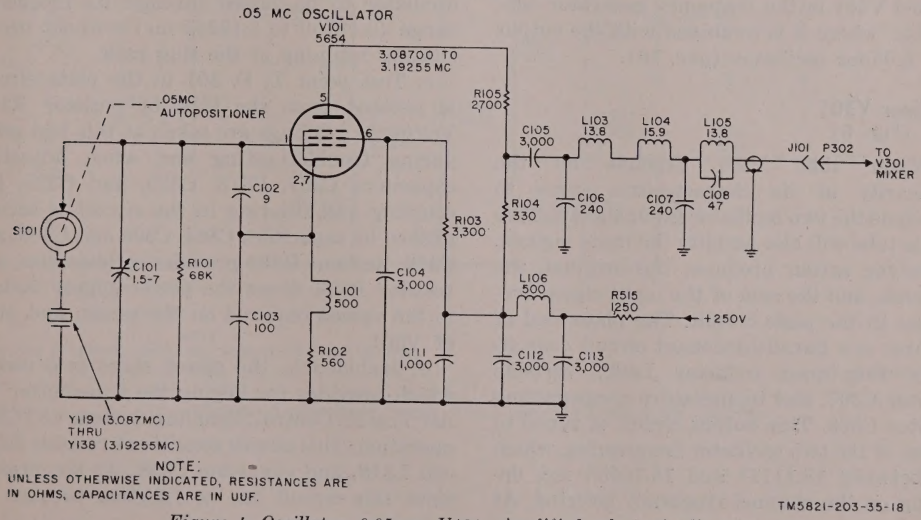

Figure 4. Oscillator, 0.05-mc, V101, simplified schematic diagram.

e. The output of the 0.05-mc oscillator (3.08700 to 3.19255 mc) is coupled through panel-mounted coaxial connector J101, connector P302, and a short length of coaxial cable to mixer V301 in the frequency generator subassembly, where it is combined with the output of the 1-mc oscillator.

17. Oscillator V201
(fig. 5)

a. The 1-mc oscillator, V201, is an electron-coupled crystal oscillator, employing one of 18 crystals (Y201 through Y218) in the frequency range of 10.02411 to 11.91300 mc. (Refer to the chart in paragraph 80*i*.) The crystals are mounted in a crystal holder board and are selected by switch S201, which is operated by the 1-mc Autopositioner unit.

b. Components used in the cathode and control and screen grid circuits have the same value and purpose as those used in the 0.05-mc oscillator (par. 16).

c. In the plate circuit, the output signal is developed across coil L202 and resistor R205. Decoupling is furnished by capacitors C210, C211 and C212 and coil L204. Capacitor C205 couples the signal to the harmonic filter combination C206, C207, and L205.

d. The output of the 1-mc oscillator (10.02411 to 11.91300 mc) is coupled through panel-mounted coaxial connector J201, connector P301, and a short length of coaxial cable, to mixed V301 in the frequency generator subassembly, where it is combined with the output of the 0.05-mc oscillator (par. 16).

18. Mixer V301
(fig. 6)

a. Mixer tube V301 depends on the nonlinearity of its characteristic curve to heterodyne the two oscillator input signals. This pentode tube will also amplify the input signals. Heterodyne action produces the original, the difference, and the sum of the input signal frequencies in the plate circuit. The plate load of the mixer is a parallel-resonant circuit consisting of slug-tuned inductor L302, variable capacitor C307, and temperature-compensating capacitor C306. This output circuit is tuned to the sum of the two oscillator frequencies, which falls between 13.11111 and 15.10555 mc, depending on the channel frequency selected. At the resonant frequency, maximum voltage is developed across the output of the mixer. At all other frequencies (the difference and original frequencies), the output voltage is very low and these frequencies are attenuated. The frequency of the tank circuit is varied from 13.11111 to 15.10555 mc by the slug in inductor L302, which is positioned by the operation of the slug rack. The slug rack is driven by the 1-mc Autopositioner unit when the 1-mc control on the control unit is varied to change the frequency in increments of 1-mc.

b. The mixer-output tuned circuit is coupled to three other similarly tuned circuits through a series of coupling capacitors (C309, C311, C316, C318, C321, and C323) and common coupling capacitors (C310, C317, and C322). The three tuned circuits, which consist of slug-tuned inductors L305, L306, and L307 with variable capacitors C313, C320 and C325, are also tuned by operation of the slug rack. Across each of the tuned circuits is a temperature-compensating capacitor: C312, C319, and C324, respectively. The combined effect of this coupling system produces a circuit which has a band pass of 200 kilocycles (kc) between the 3-decibel (db) half-power points. Beyond these points attenuation increases very rapidly. The circuit is used to eliminate unwanted mixer output signals which might cause spurious outputs from the transmitter. The 200-kc band pass characteristic is sufficient to allow the 0.05-mc oscillator to be varied through its frequency range (3.08700 to 3.19255 mc) without necessitating retuning of the slug rack.

c. Test point T. P. 301 in the plate circuit is isolated from the tube by resistor R302. Voltmeter readings are taken at this test point during troubleshooting and when adjusting capacitors C307, C313, C320, and C325. Decoupling and filtering in the circuit is accomplished by capacitors C304, C305 and C308, and C315. Resistor R303 provides cathode bias, and resistor R304 drops the power supply voltage to the values required on the screen and plate of V301.

d. Included in the mixer stage is a circuit which provides for keying the transmitter for Air Traffic Control Signaling System (ATCSS) operation. This circuit consists of resistor R313, coil L318, and capacitor C358. At the present time, this circuit has no function because as-

sociated ATCSS equipment is not yet available for use.

19. Amplifier V302

(fig. 7)

The 13-mc amplifier tube V302 is used to increase the level of the desired signal and to isolate the two sections of the selective tuning system. To prevent production of undesirable harmonics, the stage is operated as a class A amplifier.

a. The 13.11111 to 15.10555 signal voltage from mixer V301 is coupled through parasitic suppression resistor R305 to the grid of V302 across grid resistor R306. The amplified signal is coupled to the output circuit and the following stage through a series of coupling capacitors (C336, C338, C342, C344, and C349) and common coupling capacitors (C337 and C343). The output circuit is made up of three tuned circuits consisting of slug-tuned inductors L310, L311, and L312 in parallel with variable capacitors C334, C341, and C348, respectively. Across each tuned circuit is a temperature-compensating capacitor (C333, C340, C347) and a fixed trimmer capacitor (C332, C339, C346). The frequency response of this combination of tuned circuits is approximately the same as the combination of tuned circuits in the mixer output circuit (par. 18*b*). The selectivity of the two combinations of tuned circuits virtually eliminates any unwanted signals from the input to the first tripler. Operation of the slug rack by the 1-mc Autopositioner unit tunes the inductors to frequencies between 13.11111 and 15.10555 mc, depending on the channel selected.

b. Plate and screen voltage for the 13-mc amplifier is furnished by the 250-volt supply from the dynamotor. Screen voltage is applied through voltage-dropping resistor R308. Resistor R308 also forms a decoupling network with capacitors C331 and C335. Cathode bias is provided by resistor R307 and capacitors C329 and C330.

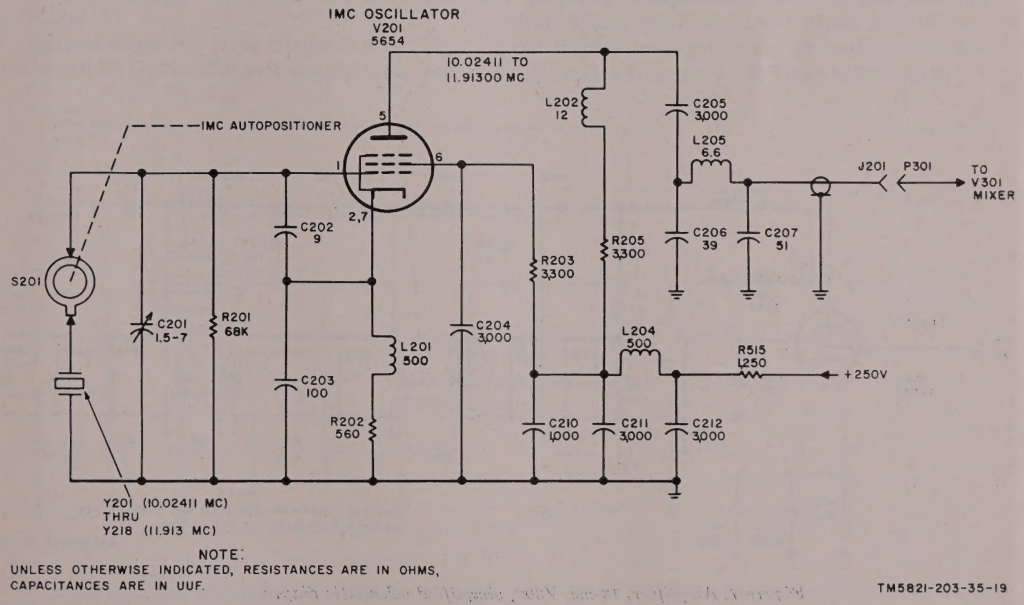

Figure 5. Oscillator, 1-mc, V201, simplified schematic diagram.

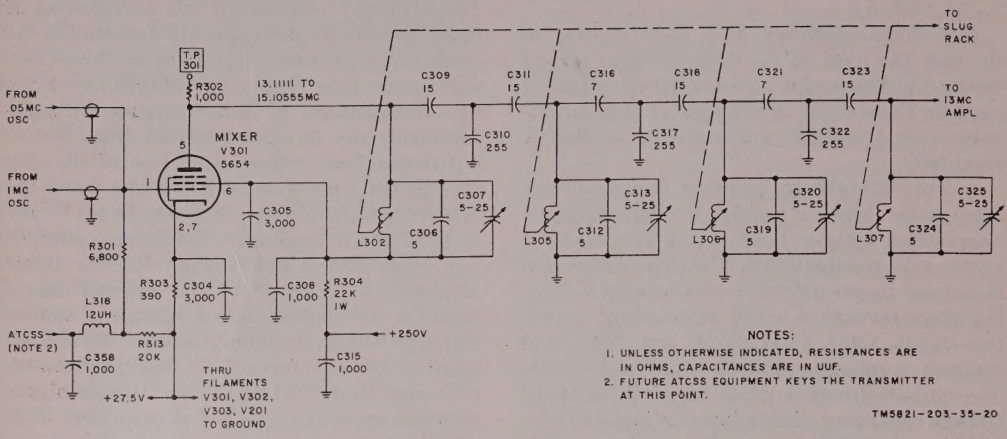

Figure 6. Mixer V301, simplified schematic diagram.

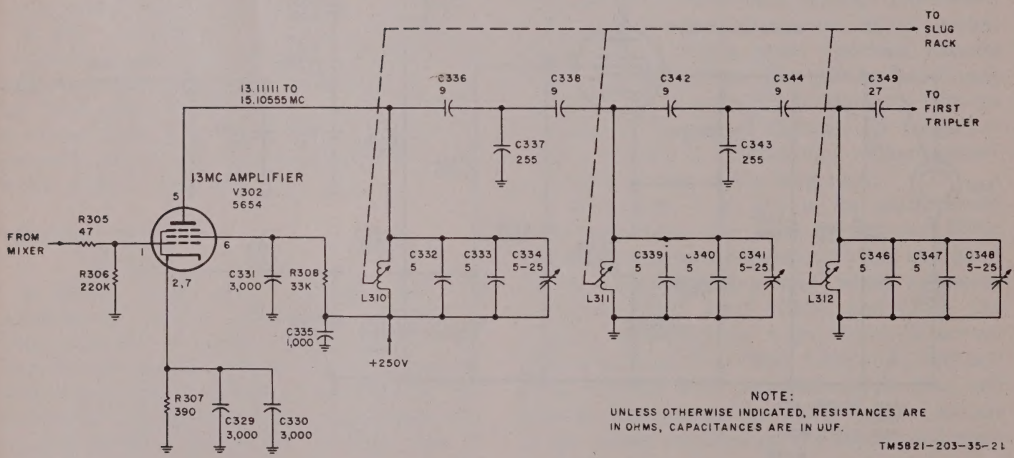

Figure 7. Amplifier, 13-mc, V302, simplified schematic diagram.

20. First Tripler V303 (fig. 8)

First tripler V303 triples the frequency of the signal applied to its grid from the 13-mc amplifier; the input frequency to the first tripler is between 13.11111 and 15.10555 mc, and the output frequency is between 39.33333 and 45.3 1665 mc.

a. First tripler V303 is operated class C. Cathode bias is developed across cathode resistor R311 (shunted by bypass capacitor C354), and current flowing through grid resistors R309 and R310 develops grid leak bias. This combination bias and the amplitude of the input signal set an operating point for the tube which produces maximum third harmonic output. Capacitor C345 bypasses unwanted signal voltages and prevents them from developing across resistor R310 which acts as a meter shunt for test point T.P.302. Test point T.P.302 provides for the connection of an ammeter when troubleshooting, and for use while adjusting inductors L302, L305, L306, L307, L310, L311, and L312 (fig. 6 and 7).

b. Plate voltage for first tripler V303 (fig. 8) is furnished by the 250-volt supply from the dynamotor through rf coil L315 which isolates the rf signal voltage from the +250-volt supply. Screen voltage is furnished from the 250-volt supply through coil L315 and voltage-dropping resistor R312. Filtering is provided by bypass capacitors C352 and C353.

c. The plate load for the first tripler stage is a parallel-resonant circuit consisting of coil L316, variable capacitor C356, and temperature-compensating capacitor C355. This resonant circuit is tuned to the third harmonic by L316 (39.33333 to 45.31665 mc) of the input signal which is positioned by operation of the slug rack. Coil L317 link-couples the output signal (39.33333 to 45.31665 mc) through a short length of coaxial cable from the frequency generator subassembly to the second tripler in the rf amplifier subassembly.

21. Second Tripler V401 (fig. 9)

Second tripler tube V401, is located in the rf amplifier subassembly. It is driven by the output signal (39.33333 to 45.31665 mc) of the first tripler and produces an output at the final carrier frequency (118.0 to 135.95 mc).

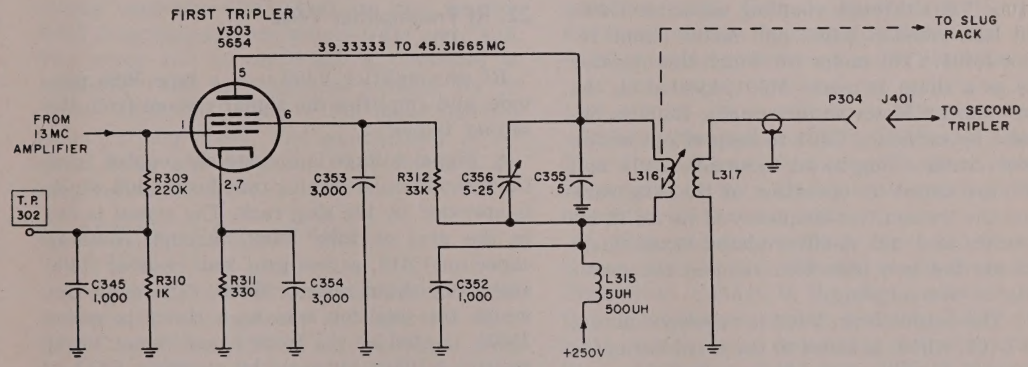

Figure 8. First tripler V303, simplified schematic diagram.

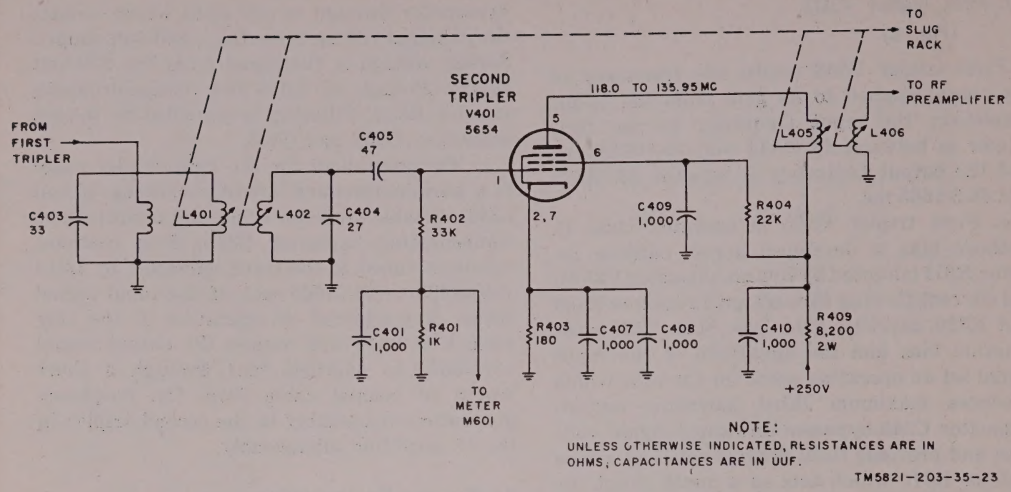

Figure 9. Second tripler V401, simplified schematic diagram.

a. The output signal from first tripler V303 is link-coupled to the input circuit of second tripler V401. The input circuit consists of capacitor C403 in parallel with inductor L401 to form a series-resonant circuit. This circuit is inductively coupled to a second series-resonant circuit consisting of C404 and L402. The output from this circuit is coupled to the grid of tube V401 through coupling capacitor C405, grid leak resistor R402, and meter shunt resistor R401. (The meter for which this resistor acts as a shunt is meter M601, located on the front panel.) Meter shunt resistor R401 is bypassed by capacitor C401 to keep rf out of the meter circuit. Slug-tuned inductors L401 and L402 are tuned by operation of the slug rack when the transmitter frequency is varied in increments of 1 mc. A silver-plated brass shield between the two inductors reduces the possibility of overcoupling.

b. The output from V401 is developed across coil L405, which is tuned to the third harmonic (118.0 to 135.95) of the input signal. The coil and the distributed capacitance of the circuit form a resonant circuit which is tuned to the third harmonic by an iron slug positioned within the coil by the slug rack when operated by the 1-mc Autopositioner unit. The output is inductively coupled through coil L406 to the input of the rf preamplifier stage.

c. Plate and screen voltage for tube V401 is furnished by the 250-volt supply from the dynamotor through voltage-dropping resistors R409 and R404. Filtering is provided by capacitors C409 and C410 in the screen and plate circuits. Cathode bias resistor R403 is bypassed by capacitors C407 and C408.

22. Rf Preamplifier V402 (fig. 10)

Rf preamplifier V402 uses a type 5686 pentode, and amplifies the signal voltage from the second tripler.

a. Signal voltage is inductively coupled from the second tripler by slug-tuned coil L406 which is operated by the slug rack. The signal is fed to the grid of tube V402, through coupling capacitor C413, across grid leak resistor R406 and meter shunt resistor R405. (The meter for which this resistor acts as a shunt is meter M601, located on the front panel. Meter shunt resistor R405 is bypassed by capacitor C411 to keep rf out of the meter circuit. The amplified output voltage is developed across coil L407, which is also tuned by the slug rack. Plate coil L407 is a center-tapped inductor used to provide two outputs and proper phase relationship of signals necessary to operate the push-pull rf driver stage.

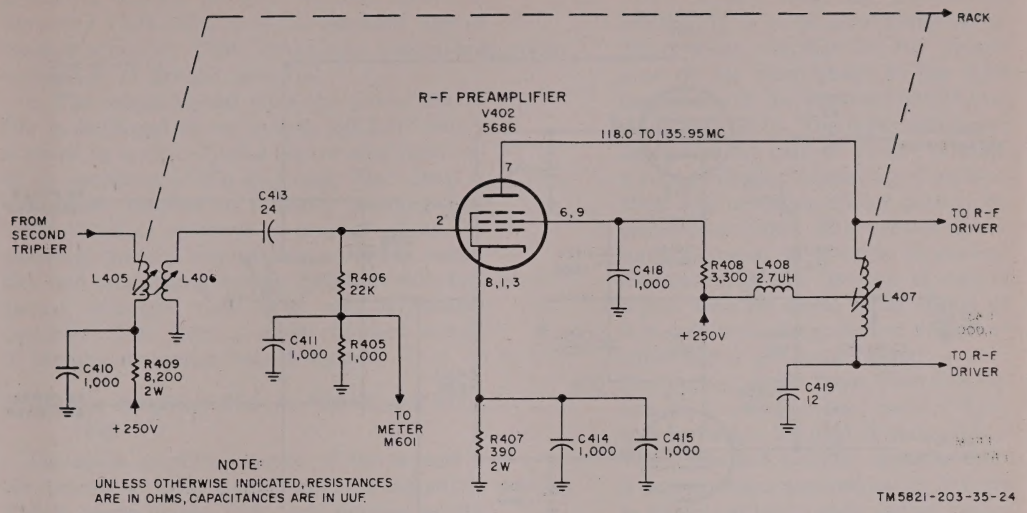

Figure 10. Rf preamplifier V402, simplified schematic diagram.

b. Plate voltage for tube V402 is supplied from the dynamotor 250-volt supply through rf coil L408 via the center tap of coil L407. Screen voltage is supplied from the dynamotor 250-volt supply through voltage-dropping resistor R408, which forms a decoupling network with bypass capacitor C418. Cathode bias resistor R407 is bypassed by capacitors C414 and C415. The lower end of coil L407 is connected to capacitor C419 and develops voltage for rf driver V404. Coil L405 is the plate load for second tripler V401. The combination of resistor R409 and capacitor C410 forms a decoupling network.

23. Rf Drivers V403 and V404 (fig. 11)

Rf driver tubes V403 and V404 are connected in push-pull arrangement and operated as a class C amplifier. The rf carrier signal from the preamplifier is amplified by the two vacuum tubes (type 5686) to the level needed to excite the power amplifier.

a. The output signals from the rf preamplifier stage are capacitively coupled to the grids of each driver amplifier by capacitors C420 and C421. Coils L409 and L410 are used to increase the impedance from grid to ground to develop maximum signal on the grid. The dc resistance of the coils is low and does not affect grid leak bias. Grid leak bias is controlled by the values of resistors R410 and R411, which are connected to ground through meter shunt resistor R412. The meter shunt resistor is bypassed by capacitor C433. Cathode resistors R413 and R414 (shunted by bypass capacitors C425 and C426) provide protective bias for the tubes.

b. The output signals from each tube are 180° out of phase with each other and developed across tuned circuit C438 and L415. This circuit is tuned by means of a silver-plated copper slug in coil L415, which is positioned by operation of the slug rack.

c. Plate and screen voltage for the rf drivers is furnished by the 250-volt supply from the dynamotor. Voltage to the screen grids is fed through voltage-dropping resistors R415 and R416, which form decoupling networks with bypass capacitors C431 and C432. Voltage to the plates is fed to the center tap of coil L415 from the positive 250-volt supply through rf coil L414. Included in the positive 250-volt path are screen and plate voltage-dropping resistor R421 and a filter network consisting of isolation coils L420 and L411, and capacitors C434, C446, C422, C447, C412, and C445.

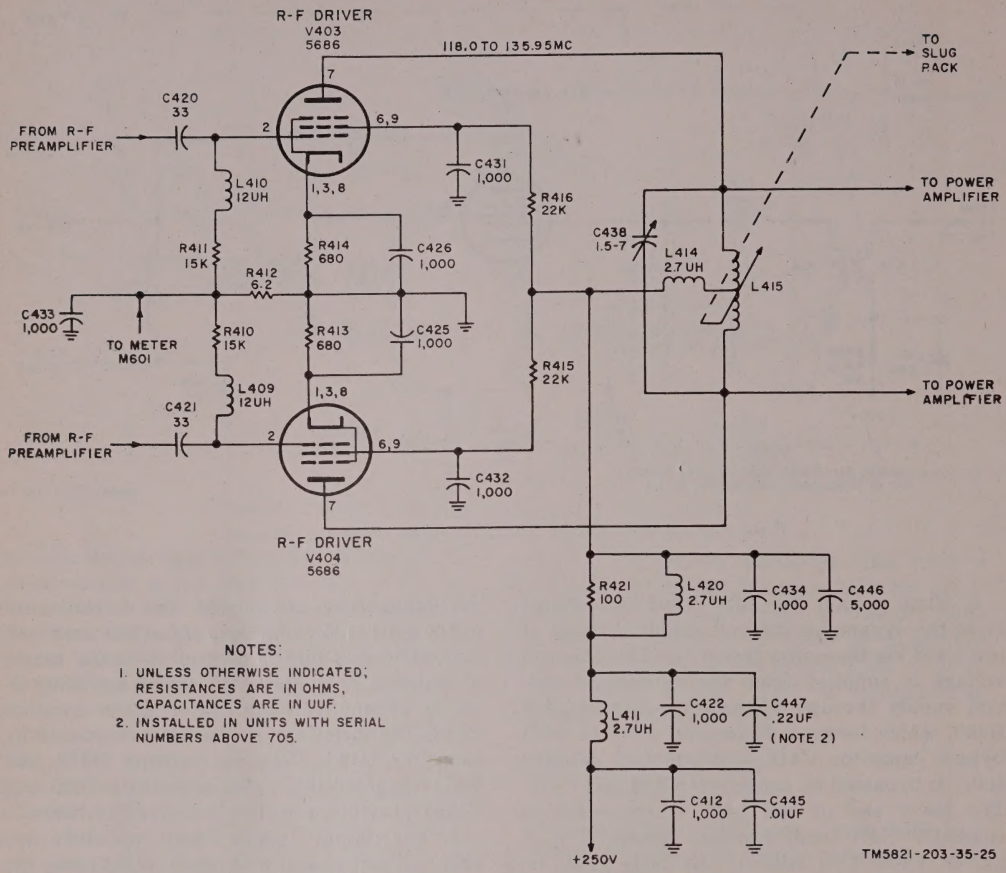

Figure 11. Rf drivers V403 and V404, simplified schematic diagram.

24. Power Amplifier V405 (fig. 12)

Power amplifier tube V405 is a type 9903/5894 twin tetrode built in a single envelope and operated as a push-pull class C amplifier. The circuitry is such that, combined with the tube construction, it produces a stable final amplifier.

a. The two output signals (118.0 to 135.95 mc) from the rf drivers are capacitively coupled to the control grids of V405 by coupling capacitors C436 and C437. Included in the grid circuits are rf coils L421 and L422 and grid leak resistors R417 and R418. The grid leak resistors are connected to ground through meter shunt resistor R419.

b. Plate voltage for the power amplifier is furnished by the 375-volt supply from the dynamotor, through rf coil L419, to the center tap of output tuning coil L417. Screen voltage is furnished by the 250-volt supply from the dynamotor through a resistor and the modulation transformer which drops the voltage to 190 volts. Included in the plate and screen circuits are bypass capacitors C443 and C440. The cathode of V405 is connected to the 27.5-volt supply through meter shunt resistor R420. If excitation is removed from the control grid and grid leak bias is eliminated, the positive 27.5 volts on the cathode can be used as a fixed

protective bias for the tube. Resistor R420 and capacitor C444 form a series-resonant circuit bypass capacitor C439 effectively places the cathode at rf ground potential.

c. The output signal from the power amplifier is developed across output coil L417 which is tuned by a silver-plated copper slug positioned by operation of the slug rack. The signal is inductively coupled to antenna coupling link L418 which is shielded to prevent capacitive coupling, thereby suppressing harmonic radiation and minimizing output variation with frequency changes. Coil L418 and adjustable capacitor C444 form a series-resonant circuit to produce maximum output signal.

25. Audio Amplifier V501A, V501B, and V502 (fig. 13)

The audio amplifier section of the transmitter consists of three stages: audio preamplifier V501A, audio driver V502, and sidetone amplifier V501B.

a. Audio Preamplifier and Audio Driver Tubes, V501A and V502. The purpose of the audio preamplifier and the audio driver is to amplify the weak input signals from the microphone to the level necessary to drive the modulator. Included in the preamplifier stage is potentiometer R503 that controls the level of modulation.

(1) Voice signals from the microphone are applied to audio input transformer T501, which matches the low impedance of the microphone to the high impedance of the input circuit of preamplifier V501A. The voice signals are applied to the grid of V501A through a voltage divider consisting of resistor R502 and modulation-level control potentiometer R503. This control is initially adjusted to provide 90-percent modulation of the 25-watt rf output signal with an audio input signal of 0.25-volt root mean square (rms) at 1,000 cycles per second (cps).

(2) The output signal from V501A is developed across plate load resistor R505 and coupled to the grid of audio driver V502. The audio driver operates class A and produces approximately 2 watts in its output load (audio output transformer T502). Bias is provided by cathode resistor R508.

(3) Capacitor C503 and resistor R507 make up a feedback loop which couples part of the output signal voltage from the driver back to the preamplifier across cathode resistor R504. This is negative feedback and reduces the possibility of overmodulating the carrier.

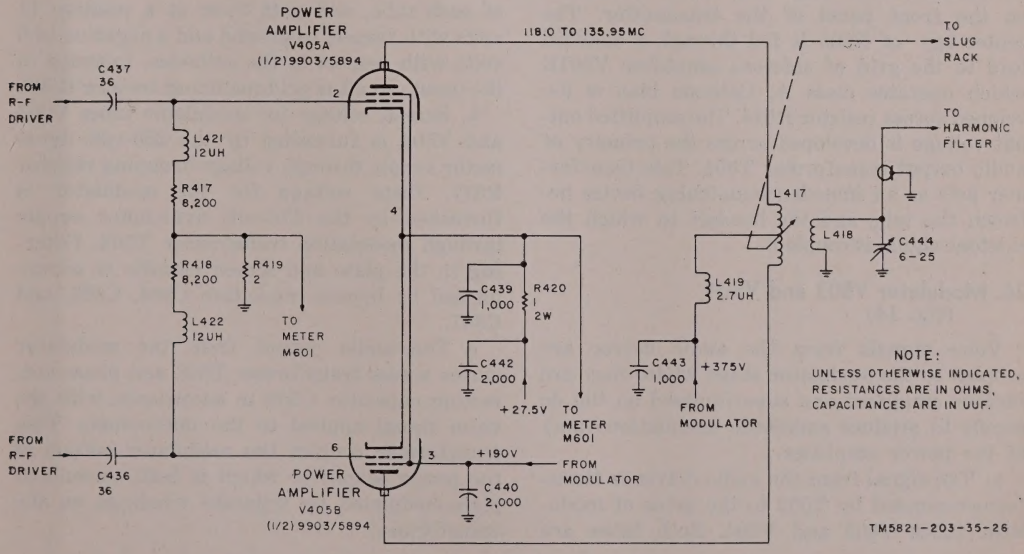

Figure 12. Power amplifier V405, simplified schematic diagram.

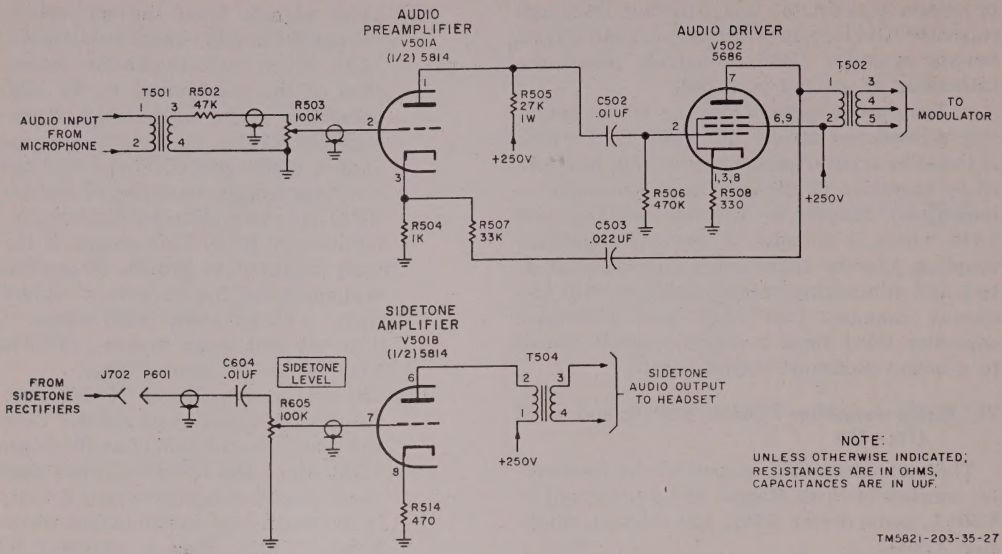

Figure 13. Audio amplifiers V501A, V501B, and V502, simplified schematic diagram.

b. Sidetone Amplifier V501B. The output signal from the sidetone detector (fig. 15) is coupled through a shielded lead and coupling capacitor C604 to SIDETONE LEVEL potentiometer R605 (fig. 13), which is located on the front panel of the transmitter. The center tap of R605 is fed through a shielded lead to the grid of sidetone amplifier V501B which operates class A. Cathode bias is developed across resistor R514. The amplified output voltage is developed across the primary of audio output transformer T504. This transformer acts as an impedance-matching device between the tube and the headset to which the sidetone signal is coupled.

26. Modulator V503 and V504 (fig. 14)

Voice signals from the audio driver are coupled to the modulator stage where they are further amplified and superimposed on the dc supply to produce amplitude modulation (am) of the power amplifier.

a. The signal from the audio driver is transformer-coupled by T502 to the grids of modulator tubes V503 and V504. Both tubes are operated with a fixed bias which is developed from a voltage divider network made up of resistors R510 and R511. The junction point of these two resistors is connected through the secondary of transformer T502 to the grids of each tube, and puts them at a positive 11 volts with respect to ground and a negative 16.5 volts with respect to the cathodes. Included in the input circuit is grid-matching resistor R509.

b. Screen voltage for modulator tubes V503 and V504 is furnished by the 250-volt dynamotor supply through voltage-dropping resistor R517. Plate voltage for the modulator is furnished by the 375-volt dynamotor supply through modulation transformer T503. Filtering in the plate and screen circuits is accomplished by bypass capacitors C506, C505, and C507.

c. The audio output from the modulator varies across transformer T503 and phase-correction capacitor C508 in accordance with the voice signal applied to the microphone. This transformer couples the modulator output to the power amplifier which is both screen-and plate-modulated by separate windings on the transformer.

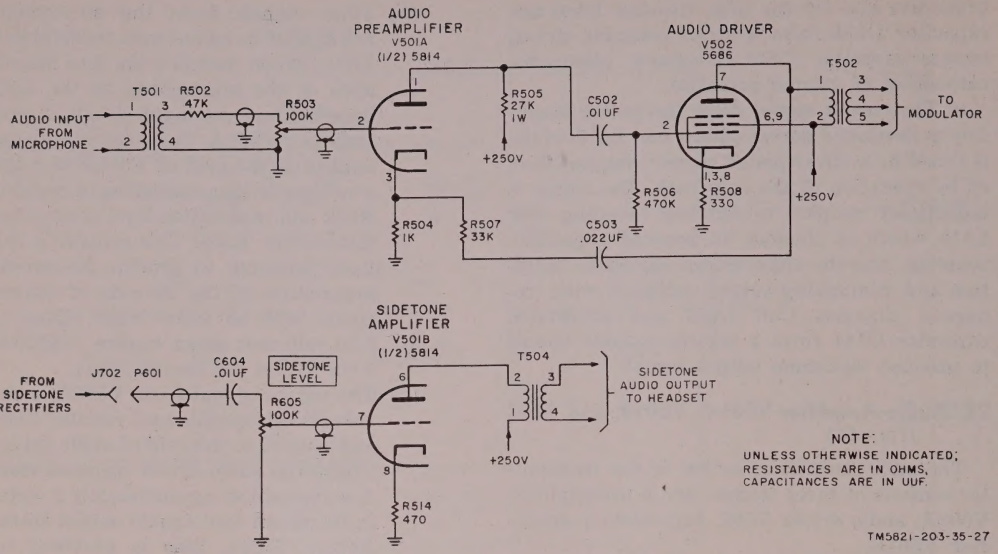

Figure 13. Audio amplifiers V501A, V501B, and V502, simplified schematic diagram.

b. Sidetone Amplifier V501B. The output signal from the sidetone detector (fig. 15) is coupled through a shielded lead and coupling capacitor C604 to SIDETONE LEVEL potentiometer R605 (fig. 13), which is located on the front panel of the transmitter. The center tap of R605 is fed through a shielded lead to the grid of sidetone amplifier V501B which operates class A. Cathode bias is developed across resistor R514. The amplified output voltage is developed across the primary of audio output transformer T504. This transformer acts as an impedance-matching device between the tube and the headset to which the sidetone signal is coupled.

26. Modulator V503 and V504 (fig. 14)

Voice signals from the audio driver are coupled to the modulator stage where they are further amplified and superimposed on the dc supply to produce amplitude modulation (am) of the power amplifier.

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b. Screen voltage for modulator tubes V503 and V504 is furnished by the 250-volt dynamotor supply through voltage-dropping resistor R517. Plate voltage for the modulator is furnished by the 375-volt dynamotor supply through modulation transformer T503. Filtering in the plate and screen circuits is accomplished by bypass capacitors C506, C505, and C507.

c. The audio output from the modulator varies across transformer T503 and phase-correction capacitor C508 in accordance with the voice signal applied to the microphone. This transformer couples the modulator output to the power amplifier which is both screen-and plate-modulated by separate windings on the transformer.

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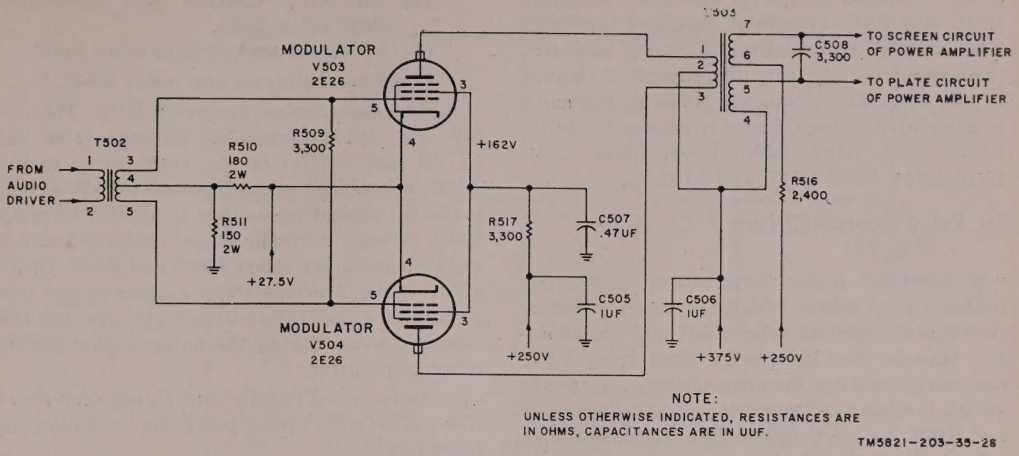

Figure 14. Modulators V503 and V504, simplified schematic diagram.

27. Harmonic Filter and Sidetone Detector (fig. 15)

The amplitude-modulated carrier from the final amplifier is carried through coaxial cable to the harmonic filter and the sidetone detector. The harmonic filter consists of two *m*-derived end sections (C701, C702, L701 and C705, C706, L703), with a constant *k* center section (C703, L702, C704) which produces very little attenuation to the fundamental output frequency of the transmitter. However, it sharply attenuates the output from the transmitter at all frequencies in the second, third, and fourth harmonic ranges of the carrier. The voltage-doubling sidetone detector circuit consists of two type 1N63 crystal diodes followed by capacitors C708 and C709, and coil L704, which make up a filter section that prevents rf from feeding into the sidetone amplifier circuit. That portion of the rf carrier to be used as sidetone is coupled to the detector through coupling capacitor C707.

28. Dynamotor D501 and B+ Distribution (fig. 16)

a. Plate and screen grid voltage is supplied to the various circuits of the transmitter by dynamotor D501. The motor section of D501 receives power from the 27.5-volt primary system when relay K501 is energized by operation of the microphone push-to-talk switch. The generator produces a dual output of approximately 250 and 350 volts. The negative lead of the 250-volt section is grounded. The negative lead of the 350-volt section is returned to the positive side of the primary supply, resulting in a voltage of approximately 375 volts to ground. Resistors R515, R516, R517, and R520 drop the output of the 250-volt section to the appropriate levels for application to the low-power and audio stages. The full output of the 375-volt section is applied to the plates of the power amplifier and modulator stages. The dynamotor is cooled by an impeller located on the armature shaft. A thermal overload switch, included in the dynamotor assembly, opens the motor circuit if the dynamotor overheats.

b. A filter network in the frequency generator subassembly consists of filter capacitors C315 and C326 and isolation coils L308 and L309. Another filter network, in the rf amplifier subassembly, consists of capacitors C447, C422, C434, C446, C412 and C445 and isolation coils L411 and L420.

29. Filament Voltage Distribution (fig. 17)

The filaments of the tubes employed in the transmitter operate directly from the 27.5-volt primary supply and are connected together with voltage-dropping resistor R519, in a series-parallel arrangement designed to provide the

proper filament voltage for each tube. Resistors R512 and R513 are shunt resistors for tubes V503 and V504. Isolating rf chokes are used throughout the circuitry to prevent rf current in one stage from entering tubes in the same or associated strings. These rf chokes are L416, L413, L412, L404, L403, L301, L303, L304, L313, L314, L203, L107, and L102.

30. Relay Control Circuits (fig. 18)

a. General. Radio Transmitter T–595/AR contains four relays which are interconnected. Antenna changeover relay K601 and the audio-B+ transfer and dynamotor start relay K501 are energized when the microphone push-to-talk switch is closed and Autopositioner relays K602 and K603 are deenergized. The Autopositioner relays are energized whenever the frequency selection system is in operation. This relay interlock system prevents transmitting during the tuning cycle. Double-channel relay K502 (fig 66) is not directly interconnected with the other relays.

(1) Antenna changeover relay K601.

(2) Audio-B+ transfer and dynamotor start relay K501.

(3) 0.05-mc Autopositioner relay K602.

(4) 1-mc Autopositioner relay K603.

b. Antenna Changeover Relay K601. This relay (fig. 18) switches the antenna from the RCVR jack (J601) on the front panel to the ANT jack (J602) when the push-to-talk switch is closed. Operating voltage is applied to relay K601 through normally closed contacts 1 and 2 on Autopositioner relays K602 and K603. Operation of the Autopositioner system causes one or both of these relays to operate, opening the contacts, thus making the antenna changeover relay inoperative.

c. Audio-B+ Transfer and Dynamotor Start Relay K501. This relay performs the following functions:

(1) Controls dynamotor primary power.

(2) Interrupts the 250 volts supplied by the dynamotor to the transmitter when the Autopositioner system is turning to a new frequency setting.

(3) Controls receiver disabling voltage.

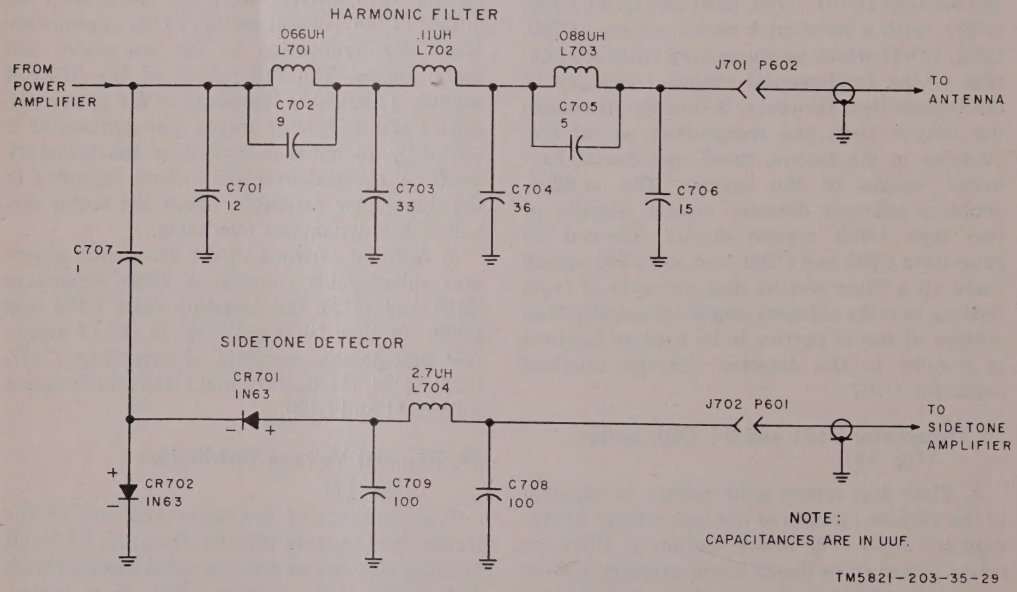

Figure 15. Harmonic filter and sidetone detector, simplified schematic diagram.

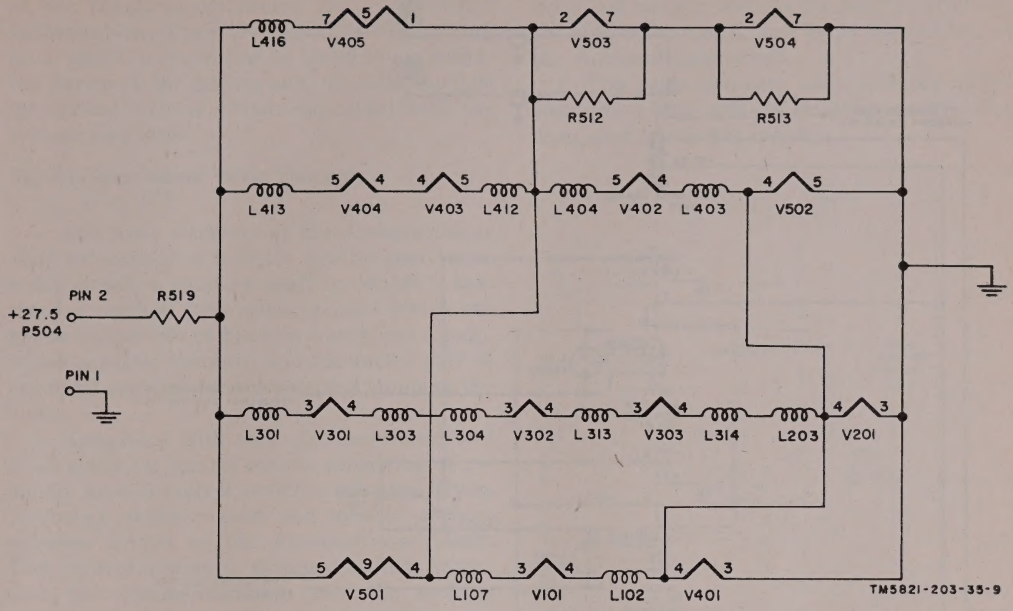

Figure 17. Filament circuits, simplified schematic diagram.

(4) Provides control of an external audio muting circuit. The three audio muting contacts on the relay may be used for controlling sidestone output. Operating voltage (27.5 volts dc) is applied to the relay through normally closed contacts 1 and 2 on Autopositioner relays K602 and K603 and the microphone push-to-talk switch. When the push-to-talk switch is closed, and the transmitter is not tuning, relay K501 is energized and supplies a ground to dynamotor. At the same time the relay closes, the 250-volt line to the transmitter applies 27.5 volts dc to pin 28 on plug P504 and connects pin 14 on plug P504 to pin 15.

d. Autopositioner Relays K602 and K603. Autopositioner relay K602 or K603 is operated when the respective 0.05-mc or 1-mc control is operated on the control unit. Relay K603 is energized through contacts on seeking switch wafers S601A and S601B and the corresponding switch wafers on the control unit (fig. 21). The power circuit for Autopositioner motor B601 is completed through normally open contacts 3 and 4 on either relay (fig. 18). Operation of either dial control on the control unit shorts to ground the return side of the solenoid of the corresponding Autopositioner relay, thus closing the circuit to the Autopositioner motor. The motor drives the seeking switches on the front panel until an open circuit is found; this causes the operated Autopositioner relay to be deenergized. The motor then stops at a position corresponding to the dial setting on the control unit.

e. Double-Channel Relay K502. Double-channel relay K502 (fig. 66), when energized, causes the 1-mc Autopositioner unit to tune 6 mc above the setting of controls on the control unit. It is not used with Frequency Selector Control C–1915/AR.

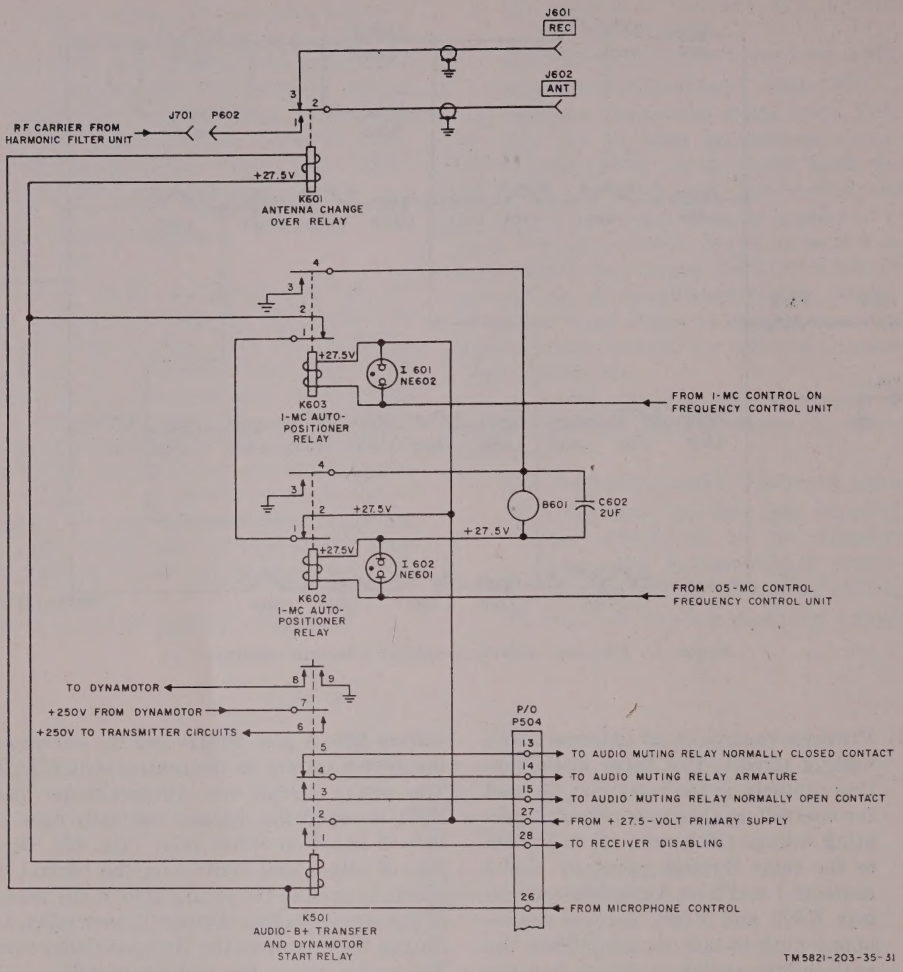

Figure 18. Relay control circuits, simplified schematic diagram.

Section II. THEORY OF FREQUENCY SELECTION SYSTEM

31. Purpose of Autopositioner System

a. To provide automatic remote selection of the transmitting frequency, Radio Transmitter T–595/AR is equipped with an Autopositioner system. The Autopositioner system is a motor-driven, rotary-positioning mechanism that will set a shaft of any one of a given number of angular positions by remote control. It consists of the following units which are both driven by a common motor and controlled by a 13-wire simplified control system:

(1) Megacycle-determining unit.

(2) 0.05 megacycle-determining unit.

b. The megacycle-determining unit, controlled by the 1-mc selecting switch on the control unit, operates the megacycle crystal selector switch in the 1-mc oscillator and the slug rack which moves the tuning slugs in the coils

of the frequency generator and rf amplifier subassemblies. The 0.05-megacycle-determining unit, which is controlled by the 0.05-mc selecting switch on the control unit, operates the 0.05 mc crystal selector switch associated with the 0.05-mc oscillator.

32. Autopositioner Basic Elements (fig. 19)

a. The basic elements of the Autopositioner (fig. 19) consist of a motor and its gear train, a slip clutch, a rotating shaft on which is fastened a notched stop wheel, a pawl which engages the notches of the stop wheel, and a relay which actuates the pawl and operates a pair of electrical contacts for starting and stopping the motor.

b. Associated with each Autopositioner unit is an electrical control system consisting of remotely located control switches actuated by the frequency selector knob and similar *seeking* switches driven by the Autopositioner shaft. This control system is designed so that whenever the control switches and the seeking switches are not set to the same electrical position, the Autopositioner unit will operate and drive its shaft to the proper position so that the symmetry of the control system is restored. The seeking switch of the control circuit is adjusted so that the relay coil circuit will be opened shortly before the stop wheel reaches the point where the pawl can drop into the proper notch. The relay contacts which control the motor are mechanically operated by the pawl which drops into the stop-wheel notch.

33. Tuning Cycle

The cycle of operation of the Autopositioner is as follows:

a. The system is at rest with the control system in symmetry, the relay is deenergized, the pawl engaging a stop-wheel notch, and the motor is not operating.

b. The operator changes the setting of the frequency selector switch.

c. The control system causes the relay to operate, lifting the pawl out of the stop-wheel notch and closing the relay contacts.

d. The motor starts and drives the Autopositioner shaft and the rotor of the seeking switch.

e. The seeking switch reaches the point of symmetry and the control system opens the relay coil circuit, permits the pawl to drop into the stop-wheel notch, and stops the rotation of the Autopositioner shaft.

f. The relay contacts open and the motor coasts to a stop with its rotating energy being dissipated in the slip clutch.

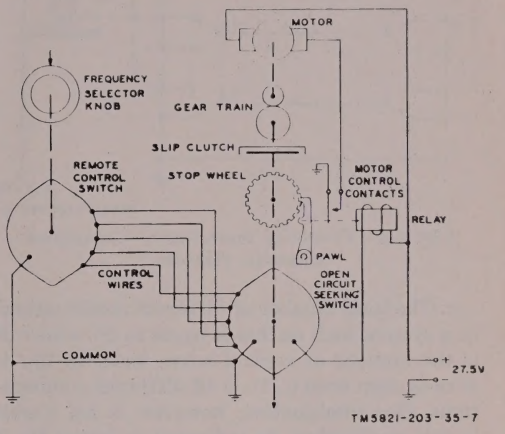

Figure 19. Autopositioner system, functional diagram.

34. Frequency Selector Control C–1915/AR

a. To provide a positive method of controlling the Autopositioner units with a minimum number of controls wires, a special simplified control system is used, with the control wires in various combinations. In Radio Transmitter T–595/AR, 6 wires plus ground are used to control the megacycle-determining Autopositioner unit (18 active positions), and 6 wires plus ground are used to control the 0.05 megacycle-determining Autopositioner unit (20 active positions).

b. This system can be understood by considering a system of single-pole double-throw switches (fig. 20). Note that when the switches are set symmetrically (S1 in the same position as S2, etc), there is no current path from the relay coil to ground, and the relay and motor will remain deenergized. If, however, any one of the control switches is set to a position different from that of its corresponding seeking switch, a path to ground will be created, energizing the relay and causing the motor to operate until the symmetry of the system is restored; this will again open the relay circuit.

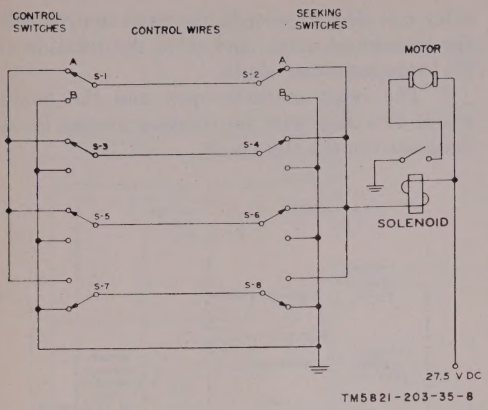

Figure 20. Frequency control system, simplified schematic diagram.

c. The total number of different combinations in a system such as this is equal to 2^N, where N is the number of control wires used. In the 4-wire system shown, $2^4 = 16$ different combinations. One combination, however, is not usable in this application. As indicated in figure 20, if all the seeking switches are set to the B position, there can be no path from coil to ground no matter how the control switches are set. Hence, the maximum number of combinations usable in this system is $2^N - 1$. Thus, a 3-wire system can control 7 positions; 4 wires, 15 positions; 5 wires, 31 positions, etc. Figure 21 shows the interconnections between Frequency Selector Control C–1915/AR and the transmitter Autopositioner units. The control wiring in the frequency control system is listed in the following chart:

Transmitter power and control connections

Pin No. on P504	Connect to	Function
A1	No connection.	
A2	27.5 vdc.	Primary power for dynamotor, maximum current 16 amperes.
1	DC ground.	
2	27.5 vdc.	Primary power for filaments, maximum current 3 amperes.
3	Control wire E.	Fractional megacycle frequency selection.
4	Control wire F.	Fractional megacycle frequency selection.
5	Control wire G.	Fractional megacycle frequency selection.
6	Control wire H.	Fractional megacycle frequency selection.
7	Control wire A.	Unit megacycle frequency selection.
8	Control wire B.	Unit megacycle frequency selection.
9	Control wire C.	Unit megacycle frequency selection.
10	Control wire D.	Unit megacycle frequency selection.
11	Control wire J.	Frequency selection, odd megacycle control.
12	Control wire K.	Frequency selection, fractional megacycle control.
13	Receiver audio.	Connects audio circuit to interphone or headphones through normally closed contact on relay K501.
14	Interphone or headphones.	Connects audio circuit through armature on relay K501.
15	Receiver audio muting circuit	Connects audio circuit through normally open contact on relay K501.
16	No connection.	Internally paralleled to pin 2 for compatability with other equipment.
17	No connection.	

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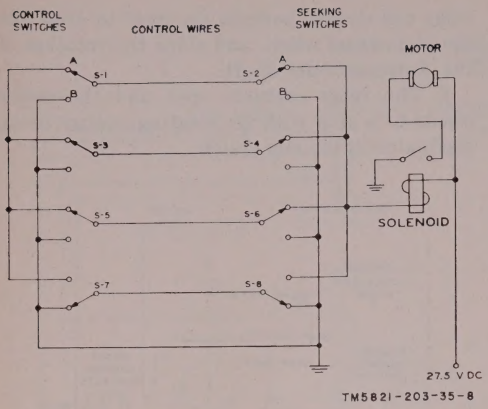

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2	27.5 vdc.	Primary power for filaments, maximum current 3 amperes.
3	Control wire E.	Fractional megacycle frequency selection.
4	Control wire F.	Fractional megacycle frequency selection.
5	Control wire G.	Fractional megacycle frequency selection.
6	Control wire H.	Fractional megacycle frequency selection.
7	Control wire A.	Unit megacycle frequency selection.
8	Control wire B.	Unit megacycle frequency selection.
9	Control wire C.	Unit megacycle frequency selection.
10	Control wire D.	Unit megacycle frequency selection.
11	Control wire J.	Frequency selection, odd megacycle control.
12	Control wire K.	Frequency selection, fractional megacycle control.
13	Receiver audio.	Connects audio circuit to interphone or headphones through normally closed contact on relay K501.
14	Interphone or headphones.	Connects audio circuit through armature on relay K501.
15	Receiver audio muting circuit	Connects audio circuit through normally open contact on relay K501.
16	No connection.	Internally paralleled to pin 2 for compatability with other equipment.
17	No connection.	

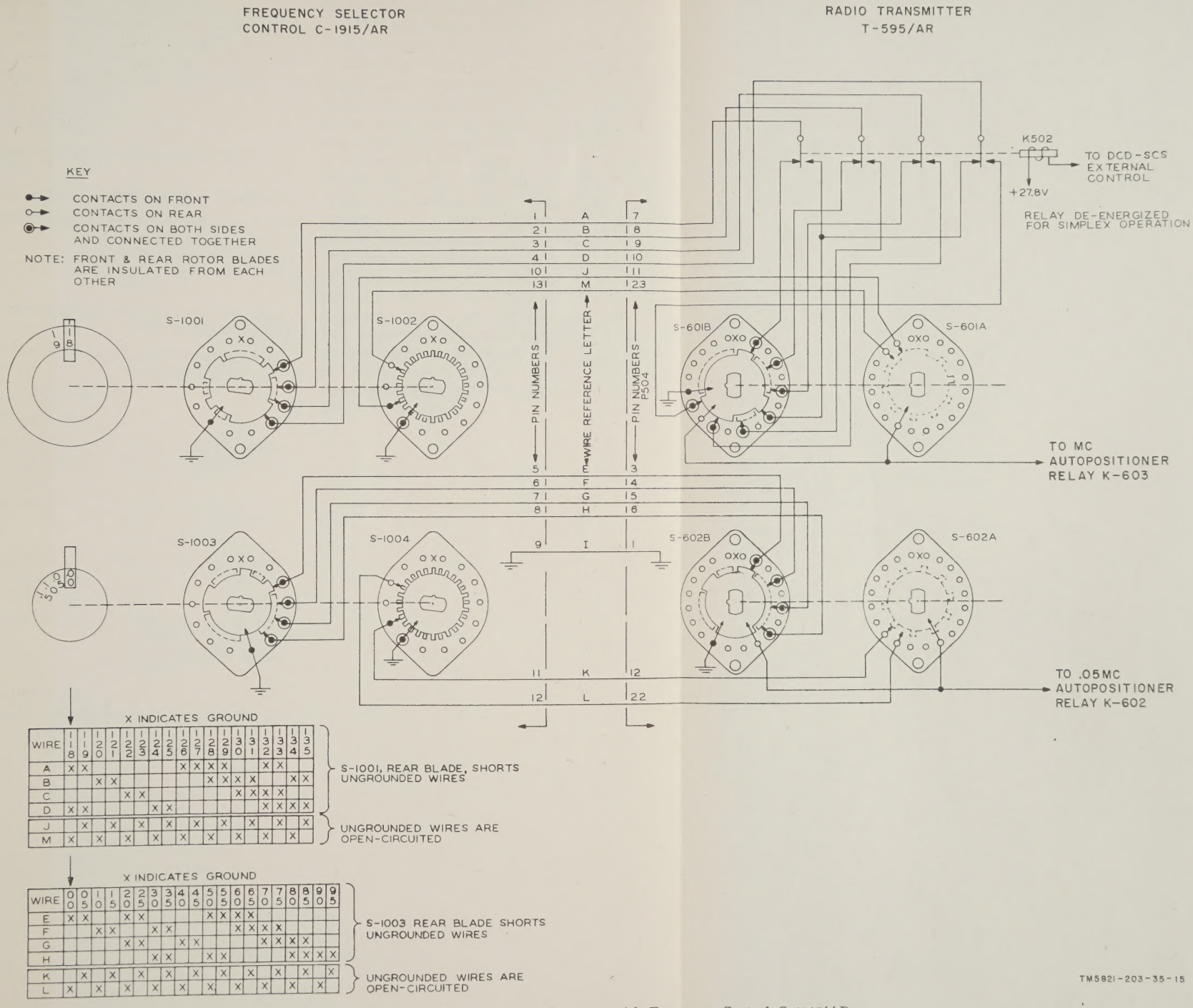


Figure 21. Frequency control system with Frequency Control C-1915/AR

Transmitter power and control connections

Pin No. on P504	Connect to	Function
18	Sidetone audio line. (Line may be grounded in aircraft).	Sidetone audio output.
19	Sidetone audio line.	Sidetone audio output.
20	Microphone.	Audio input to modulator.
21	ATCSS keying.	Keying circuit for ATCSS control of transmitter, 1,000 ohms or less to ground produces standby condition.
22	Control wire L.	Frequency selection, fractional megacycle control.
23	Control wire M.	Frequency selection, unit megacycle control.
24	No connection.	
25	No connection.	
26	Microphone push-to-talk switch.	Controls audio-B+ transfer and dynamotor start relay K501.
27	27.5 vdc.	Primary power for relay circuits, maximum current 6 amperes.
28	Receiver disabling control circuit.	Supplies 27.5 vdc to receiver when transmitter is keyed.
29	Double channel.	Causes double-channel relay K502 to be energized when DCD-DCS switch is operated.
30	No connection.	

35. Radio Transmitter T–595/AR Autopositioner System

Figure 22 is an exploded view of the Radio Transmitter T–595/AR Autopositioner system. Single motor B601 and its associated train of speed-reduction gears drives the two Autopositioner units, each of which is equipped with a slip clutch. The megacycle Autopositioner unit is controlled by seeking switches S601A and S601B and relay K603, and operates a cam-driven slug rack. A shaft driven from the main camshaft by a pair of miter gears operates crystal selector switch S201. Of the 20 positions provided by the Autopositioner, only 18 are actively used. Because the Autopositioner shaft is driven in only one direction, the remaining positions are used to provide the cam return. The 0.05 megacycle Autopositioner unit is controlled by seeking switches S602A and S602B and relay K602, and it drives a shaft by a pair of miter gears (fig. 54) which operates crystal selector switch S101.

CHAPTER 3
TROUBLESHOOTING

Section I. GENERAL TROUBLESHOOTING TECHNIQUES

***Warning*: Be extremely careful when servicing the equipment. Voltages as high as 375 volts are present in this equipment. Make all repairs or tube replacements with the primary power disconnected.**

36. General Instructions

Field and depot maintenance procedures are covered in this manual. The systematic troubleshooting procedure, which begins with the operational and sectionalization checks that can be performed at an organizational level, is carried to a higher level in this manual. Sectionalizing, localizing, and isolating techniques used in the troubleshooting procedures are more advanced than those performed at organizational maintenance.

37. Extent of Instructions

The field and depot maintenance instructions in this manual cover Electronic Equipment Maintenance Kit MK–430/ART (par. 42 through 50) and a systematic troubleshooting procedure of Radio Transmitting Set AN/ART–34. Paragraphs 52 and 53 contain interunit sectionalization procedures which must be performed at the field and depot maintenance level; paragraphs 54 through 57 contain localization and isolation techniques within the unit that must be performed at field and depot maintenance level.

38. Organization of Troubleshooting Procedures

a. General. The first step in servicing is to sectionalize the fault. Sectionalization means tracing the fault to a major component. The second step is to localize the fault. Localization means tracing the fault to the defective part responsible for the abnormal condition. Some faults, such as burned-out resistors, arcing and shorting transformers can often be located by sight, smell, and hearing. The majority of faults, however, must be isolated by checking voltages and resistances.

b. Sectionalization. Listed below is a group of tests arranged to reduce unnecessary work and to aid in tracing trouble in defective equipment. Radio Transmitting Set AN/ART–34 consists of two units: the transmitter and the control unit. The first step is to locate the unit at fault by the following methods:

(1) *Visual inspection.* The purpose of visual inspection is to locate faults without testing or measuring circuits. All meter readings or other visual signs should be observed and an attempt made to sectionalize the fault to either the transmitter or the control unit.

(2) *Operational tests.* Operational tests frequently indicate the general location of trouble. In many instances, the tests will help in determining the exact nature of the fault. The equipment performance checklist (par. 51) is a good operational test. In addition, functional tests are given in paragraphs 52 and 53.

c. Localization. The tests listed below will aid in isolating the trouble. First, localize the trouble to a single stage or circuit and then isolate the trouble within that circuit by voltage, resistance, and continuity measurements. Use the following methods of trouble localization:

(1) *Troubleshooting diagrams.* The troubleshooting diagrams (par. 55) will aid in localizing trouble to a stage.

(2) *Voltage and resistance measurements.* Make voltage and resistance measurements in this equipment *only as specified.* When measuring voltages, use tape or sleeving to insulate the entire test prod, except for the extreme tip. Use resistor and capacitor color codes to find the value of the components. Use the voltage and resistance chart (par. 57) to find normal readings, and compare them with readings taken.

(3) *Intermittent troubles.* In all these tests, the possibility of intermittent troubles should not be overlooked. If present, this type of trouble often may be made to appear by tapping or jarring the equipment. Check the wiring and connections to the units of the transmitting set.

39. Tube Testing Techniques

When the transmitter does not operate properly, check all cabling and connections before removing any tubes. Try to isolate the trouble to a component or stage. If tube failure is suspected, use the applicable procedure below to check the tubes. Refer to paragraph 40 for removal and replacement instructions for the tubes.

Caution: **Do not rock or rotate a tube when removing it from a socket; pull it straight out with a tube puller.**

a. Tube Substitution Method. Replace a suspected tube with a new tube. If the equipment remains inoperative, remove the new tube and put back the original tube. Repeat this procedure with each suspected tube until the defective tube is located.

b. Use of Tube Tester. Remove and test one tube at a time. Discard a tube only if its defect is obvious or if the tube tester shows it to be defective. Do not discard a tube that tests at or near its minimum test limit on the tube tester. Put back the original tube or insert a new one, if required, before testing the next.

40. Removal and Replacement of Tubes

All tubes in the transmitter are made available for service by removing the left side panel. To remove the panel, lift the transmitter from the channel of the mounting and loosen the five Dzus fasteners.

a. Removal of Power Amplifier Tube V405 (fig. 44). Special care should be used when removing this tube. Proceed as follows:

(1) Remove the clips from the plate caps.
(2) Disengage the clip from the bottom of the tube.
(3) Carefully pull out the tube.

b. Removal of Modulator Tubes V503 and V504 (fig. 56). Before pulling out these tubes, first disengage the plate caps, and then loosen the screw that holds the tube clamp in place. Swing the tube clamp far enough away from the tubes so that they can be removed.

c. Removal of Tube Shields (fig. 44). The remainder of the tubes in the transmitter, except for the rf drivers, are shielded. The shields for all tubes except V402 are removed by pushing them down and twisting them counterclockwise before removing. The shield for tube V402 fits the tube tightly and has no twist catch, but it must be removed by pulling directly upward from the tube socket.

d. Replacement of Tubes. When replacing a new tube for one that is defective, make sure that the pins have not been bent; if they are, straighten them before attempting to replace them in the socket. Replace all shields and clips after the tubes have been replaced.

41. Test Equipment Required

The following chart lists test equipment required for troubleshooting Radio Transmitting Set AN/ART–34, the associated technical manuals, and the assigned common names.

Test equipment	Technical manual	Common name
Audio Oscillator TS–382C/U	TM 11–2684A	Audio oscillator
Output Meter TS-585/U	TM 11–5017	Audio meter
Test Set I-199	TM 11–2604	Dynamotor tester.
Electronic Equipment Maintenance Kit MK-430/ART (Refer to paragraph 42 through 50.)		Maintenance kit
Multimeter Meter ME-26B/U	TM 11–6625-200-12 TM 11–6625-200-35	Vtvm
Electron Tube Test Set TV-2/U (5th echelon)	TM 11–2661	Tube tester
Electron Tube Test Set TV-7/U (3rd and 4th echelon)	TM 11–5083	Tube tester
Frequency Meter AN/URM-32 (3rd echelon)	TM 11–5120	Frequency meter

Test equipment	Technical manual	Common name
Frequency Meter AN/URM-80 (4th and 5th echelon)	TM 11–5095	
Headset HS-23		Headset
Multimeter TS-352B/U	TM 11–5527	Multimeter
Microphone T–17		Microphone
Ohmmeter ZM–21/U	TM 11–2050	Ohmmeter
Power Supply PP-1104A/G	TM 11–5126	28-vdc power supply
Power Supply PP-1243/U	TM 11–5120	Frequency meter power supply
Q Meter TS-617A/U	TM 11–2635	Q-meter
Signal Generator TS-497A/URR	TM 11–5030	Signal generator
Tool Equipment TE-113		Toolkit
Wattmeter AN/URM-43A	TM 11–5133	Wattmeter

Section II. ELECTRONIC EQUIPMENT MAINTENANCE KIT MK–430/ART

42. Purpose

Electronic Equipment Maintenance Kit MK–430/ART is used for field and depot maintenance of Radio Transmitting Set AN/ART–34. It can be used either at a maintenance shop or aboard an aircraft to check the control unit, the associated wiring in the aircraft, and the transmitter Autopositioner.

43. Equipment Supplied

Figure 22 is a front panel view of Electronic Equipment Maintenance Kit MK–430/ART and shows the location of the cable connectors. Figure 24 shows the cables supplied. The chart below lists the function and the common name assigned to each unit.

Item	Function	Common name
Electronic Equipment Maintenance Kit MK–430/ART, including:	Bench test Radio Transmitter T-595/AR.	Maintenance kit
Cable assembly No. 1	Connects the maintenance kit to 27.5-vdc supply.	Cable No. 1
Cable assembly No. 2	Connects the maintenance kit to Radio Transmitter T-595/AR.	Cable No. 2.
Cable assembly No. 3	Connects the maintenance kit to the transmitter shock mount in the aircraft.	Cable No. 3.

44. Additional Equipment Required

The chart below lists the description and function of the equipment not supplied but required for operation of the maintenance kit.

Item	Description	Function
Microphone	T–17, M-52, or equivalent carbon microphone with push-to-talk switch.	Keys and modulates the transmitter under test.
Power supply	27.5 volts dc, 20 amperes maximum.	Furnishes power to the maintenance kit.
Rf wattmeter	Rf Wattmeter AN/URM–43A or equivalent.	Measures rf power output of transmitter under test.
Headset	Headset HS-23 or equivalent.	Monitors transmitter sidetone output.

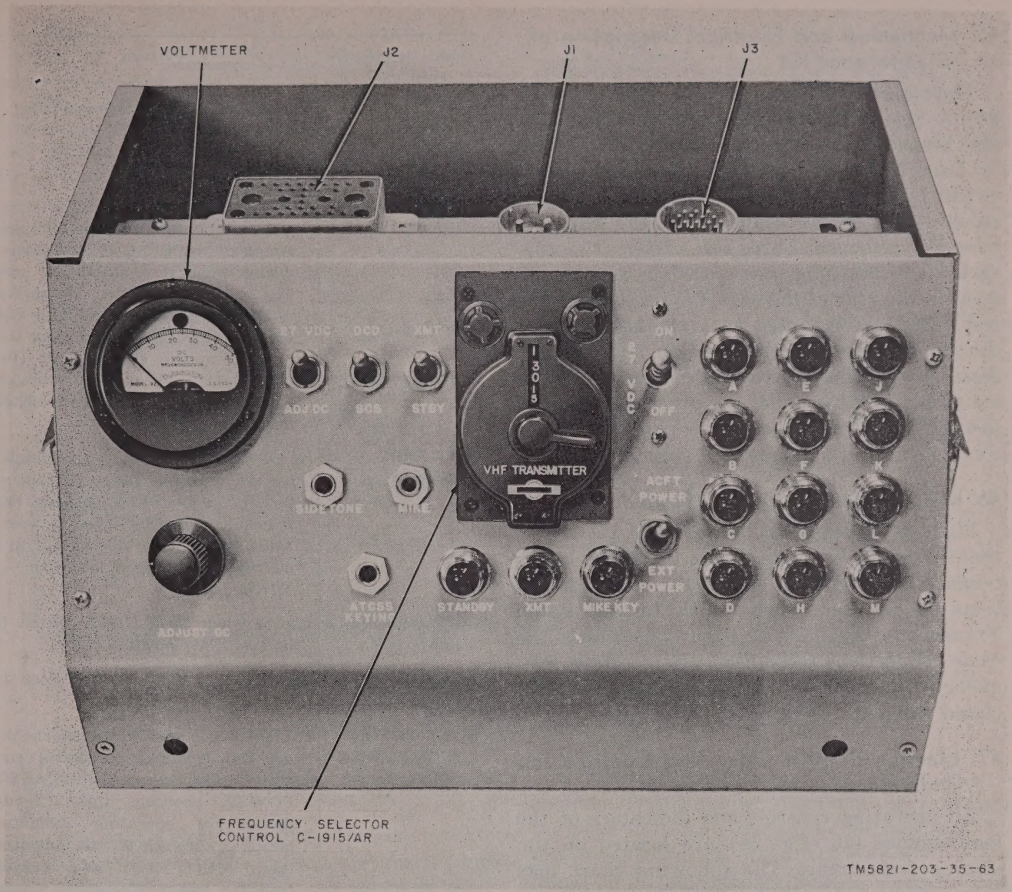


Figure 22. Electronic Equipment Maintenance Kit MK-430/ART, hinged cover removed, less cable assemblies.

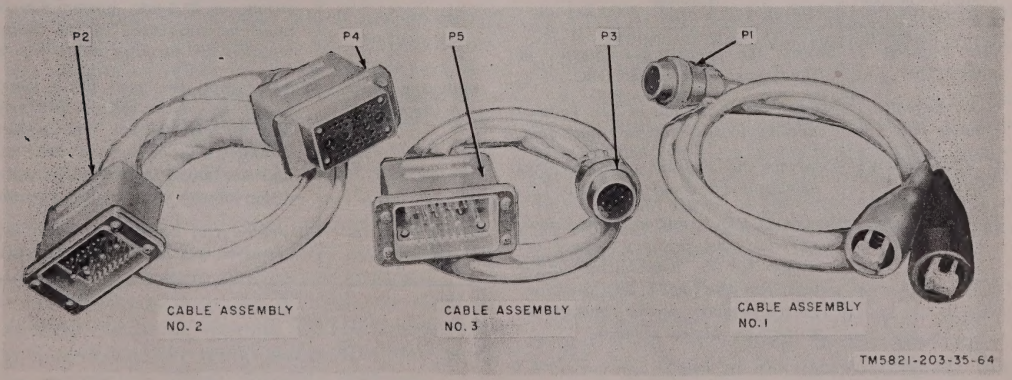


Figure 23. Cables supplied with Electronic Equipment Maintenance Kit MK-430/ART.

45. Mechanical and Electrical Description of Maintenance Kit

The maintenance kit (fig. 22) is housed in an 8½ by 8½ by 13- inch steel case with a removable hinged cover secured in the closed position by Dzus fasteners. Controls, indicators, and a circuit breaker are mounted on a sloping front panel which is accessible when the cover is raised or removed. Three test cables (fig. 23), each 60 inches long, are stored in a compartment in the rear of the case. Connectors for the test cables are mounted on a recessed shelf at the top of the maintenance kit and are accessible with the cover raised or removed. The maintenance kit includes a control unit with its associated interconnecting wiring, switches, controls, indicator lamps, and voltmeter.

46. Maintenance Kit Cabling Procedures

Figures 24 and 25 illustrate the two cable connections to be made before using the maintenance kit. Figure 24 shows the cable connections to be used when bench testing Radio Transmitter T–595/AR. Figure 25 shows the cable connections to be used when testing Frequency Selector Control C–1915/AR and associated wiring in the aircraft.

47. Maintenance Kit Operating Controls and Indicators

All operating controls and indicators of the maintenance kit (fig. 22) are located on the sloping front panel. The following chart lists each control and indicator with its function:

Control or indicator	Function
VHF TRANSMITTER	Selects the operating frequency of the transmitter under test.
0–50 vdc voltmeter	Measures magnitude of the voltage applied to transmitter under test.
27 VDC ON-OFF switch	Controls the 27.5-vdc primary power supplied through cable No. 1.
27 VDC-ADJ DC switch	In the 27 VDC position, routes power from the primary source directly to the transmitter under test. In the ADJ DC position, routes primary power through an adjustable series resistor.
ADJUST DC control	Varies the transmitter operating voltage when the 27 VDC-ADJ DC switch is in the ADJ DC position.
DD-SCS switch	Selects either DCD (double channel duplex) or SCS (single channel simplex) operation of the transmitter under test. SCS is the normal operating position. Operating in the DCD position will tune the transmitter 6 mc higher than the setting on the control unit (for control settings of 118.0 through 120.95 and 127.00 through 129.95 mc only).
XMT-STBY switch	In the XMT position, the transmitter under test is keyed on continuously. In the STBY position, the transmitter can be keyed by operating the push-to-talk switch on a microphone plugged into the MIKE jack.
XMT indicator light	Lights when XMT-STBY switch is in the XMT position.
STANDBY indicator light	Lights when XMT-STBY switch is in the STBY position.
ACFT POWER-EXT POWER switch	This switch is used only when checking the transmitter control circuits in the aircraft. In the ACFT POWER position, the 27.5-vdc power for operating indicator lamps A through M and indicator lamp MIKE KEY is obtained from the transmitter shock mount through cable No. 3. With the switch in the EXT POWER position, a 27.5-vdc power source must be connected to the maintenance kit through cable No. 1.
Indicator lamps A through M	These lamps are used for a functional test of the control unit system in the aircraft. The proper combinations of lighted and unlighted lamps indicate the condition of the control unit system.
MIKE KEY indicator lamp	Indicates the condition of the microphone key line in the aircraft.

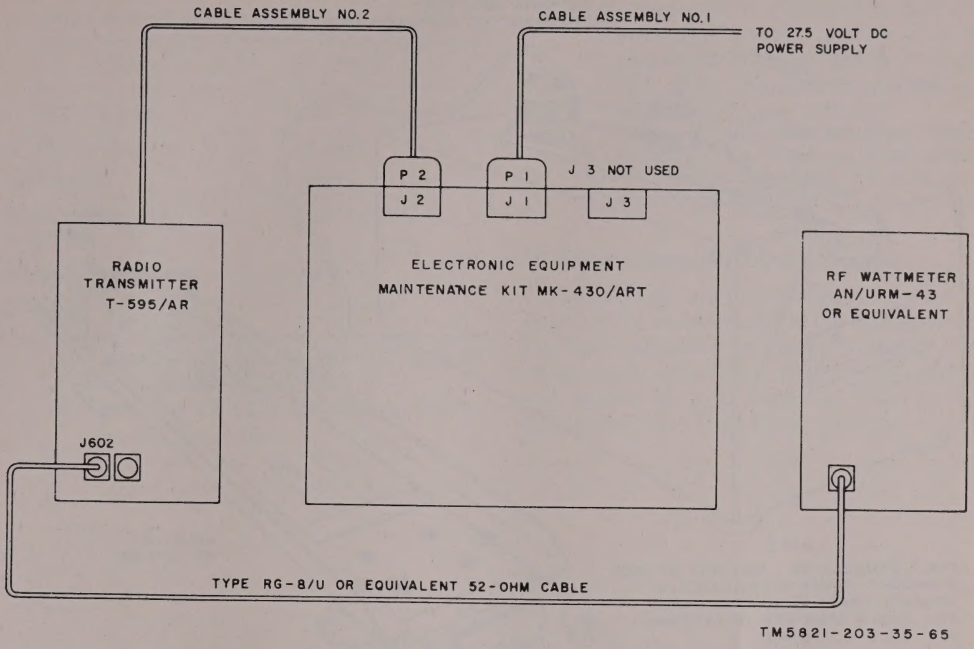


Figure 24. Cable connections when testing Radio Transmitter T–595/AR with Electronic Equipment Maintenance Kit MK-430/ART.

48. Maintenance Kit, Principles of Operation (fig. 26)

a. Frequency Selection. The maintenance kit tunes the transmitter under test by substituting another control unit for the one normally used to operate the transmitter. The control unit contains four multicontact switches (S1001, S1002, S1003 and S1004) which are operated by the control unit knob (fig. 22). The switches are connected electrically to similar motor-driven *seeking* switches in the transmitter. Whenever the control switches and the tuning switches in the transmitter are not set to the same electrical position, the motor will operate and drive the transmitter switches to the proper position for system symmetry. All tuning functions of the transmitter are performed by shafts ganged to the seeking switches.

b. ATCSS Keying. An ATCSS (Air Traffic Control Signaling System) KEYING jack (J6) is mounted on the maintenance kit front panel to provide for future signaling systems.

Note. At the present time this jack has no function because ATCSS equipment is not yet available for use.

c. Transmitter Keying. The transmitter is switched from standby to transmit by actuating the push-to-talk switch on the microphone. The push-to-talk switch operates by grounding terminal 26 of microphone jack J2, which in turn furnishes a ground return to transmit relays in the transmitter. If XMT-STBY switch S2 is operated to the XMT position, terminal 26 of J2 is grounded and the transmitter is con tinuously keyed on.

d. Sidetone. Because sidetone is generated by demodulation and amplification of part of the transmitter rf output, its presence indicates satisfactory operation of the overall equipment. The sidetone signal is fed from the transmitter through cable No. 2 and SIDETONE jack J4 to the operator's headset.

e. XMT-STBY Indicator Lamps. The STBY and XMT I14 and I15 are energized by contacts 3 and 5 on relay K501 in the transmitter. Proper operation of the lamps indicates that the audio muting contacts of relay K501 are operating correctly.

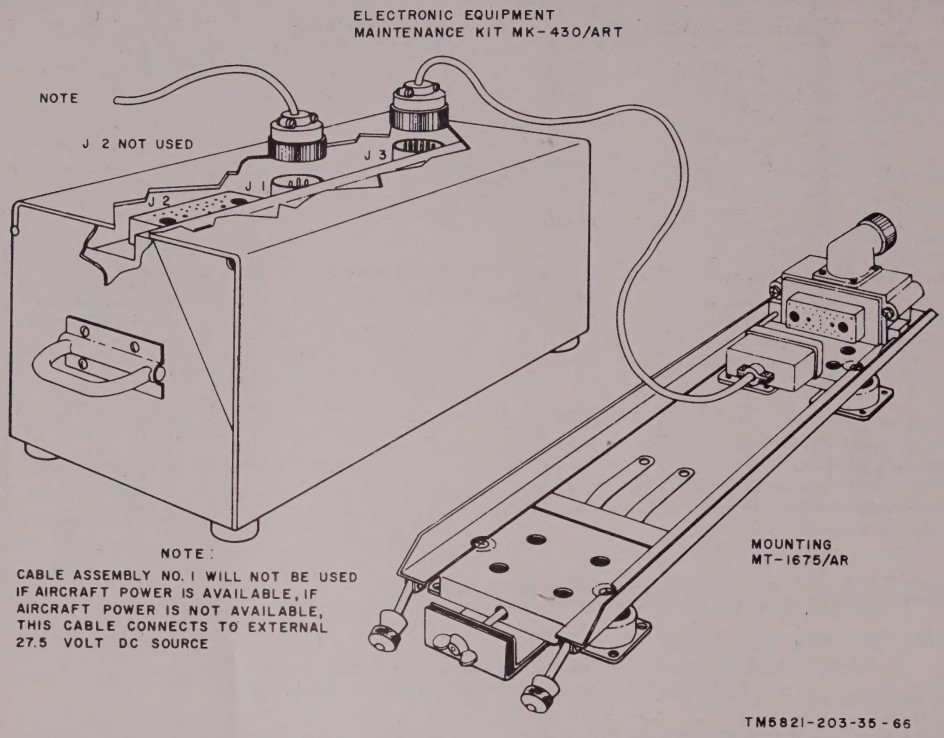

ELECTRONIC EQUIPMENT
MAINTENANCE KIT MK-430/ART
NOTE
J 2 NOT USED
J 3
J 1
J 2
NOTE:
CABLE ASSEMBLY NO. 1 WILL NOT BE USED IF AIRCRAFT POWER IS AVAILABLE, IF AIRCRAFT POWER IS NOT AVAILABLE, THIS CABLE CONNECTS TO EXTERNAL 27.5 VOLT DC SOURCE
MOUNTING
MT-1675/AR
TM5821-203-35-66

Figure 25. Cable connections when testing Frequency Selector Control C-1915/AR and associated aircraft wiring.

f. Primary Power Circuit. The primary power circuit receives 27.5 vdc power from the primary source through jack J1 and furnishes dc power to the transmitter under test. Switch S1, adjustable resistor R1, and meter M1 control and monitor the primary power. Circuit breaker CB1 protects the circuitry from overload damage.

g. Aircraft Wiring Test Circuit. Indicator lamps A through M and indicator lamp MIKE KEY are energized when ground return is furnished to the terminal, on test connector J3, associated with each lamp. The proper combinations of lighted and unlighted lamps, in conjunction with the test chart (par. 52*b*(6)), indicate the condition of the aircraft control circuit wiring.

49. Inspection and Operational Check of Maintenance Kit

a. Inspection. Visually inspect the connectors, cable assemblies, switches, lamps, and wiring of the maintenance kit. Replace any components showing evidence of wear or deterioration.

b. Operational Check. Check the maintenance kit control unit by the following procedure:

(1) Connect P1 of cable No. 1 to jack J1 on the maintenance kit.

(2) Connect P3 of cable No. 3 to jack J3 on the maintenance kit.

(3) Connect the clip leads of cable No. 1 to 27.5-volt dc source; observe the polarity. (The red clip is positive.)

(4) Set the maintenance kit front panel controls as indicated in the chart below:

Control settings of maintenance kit for operational check

Control	Position
27 VDC ON-OFF	OFF
27 VDC-ADJ DC	27 VDC
XMT-STBY	STBY
ACFT POWER-EXT POWER	EXT POWER
VHF TRANSMITTER	118.0 cm
DCD-SCS	(Not used)

(5) Connect P5 of cable No. 3 to jack J2 on the maintenance kit.

(6) Turn the 27 VDC ON-OFF switch to the ON position.

(7) Operate the control unit to each whole megacycle position and to each 0.05 megacycle position. Check the operation of the indicator lamps according to the chart (par. 52*b*(6)).

Note. If lamp indications are incorrect throughout the frequency range, check to see whether the control unit dials are incorrectly indexed.

50. Maintenance Kit Troubleshooting

The only test equipment required for troubleshooting the maintenance kit is the multimeter. Use the multimeter to make continuity checks of the cable assemblies (fig. 27, 28, and 29), and continuity and resistance checks of the maintenance kit (fig. 26, 30, and 31).

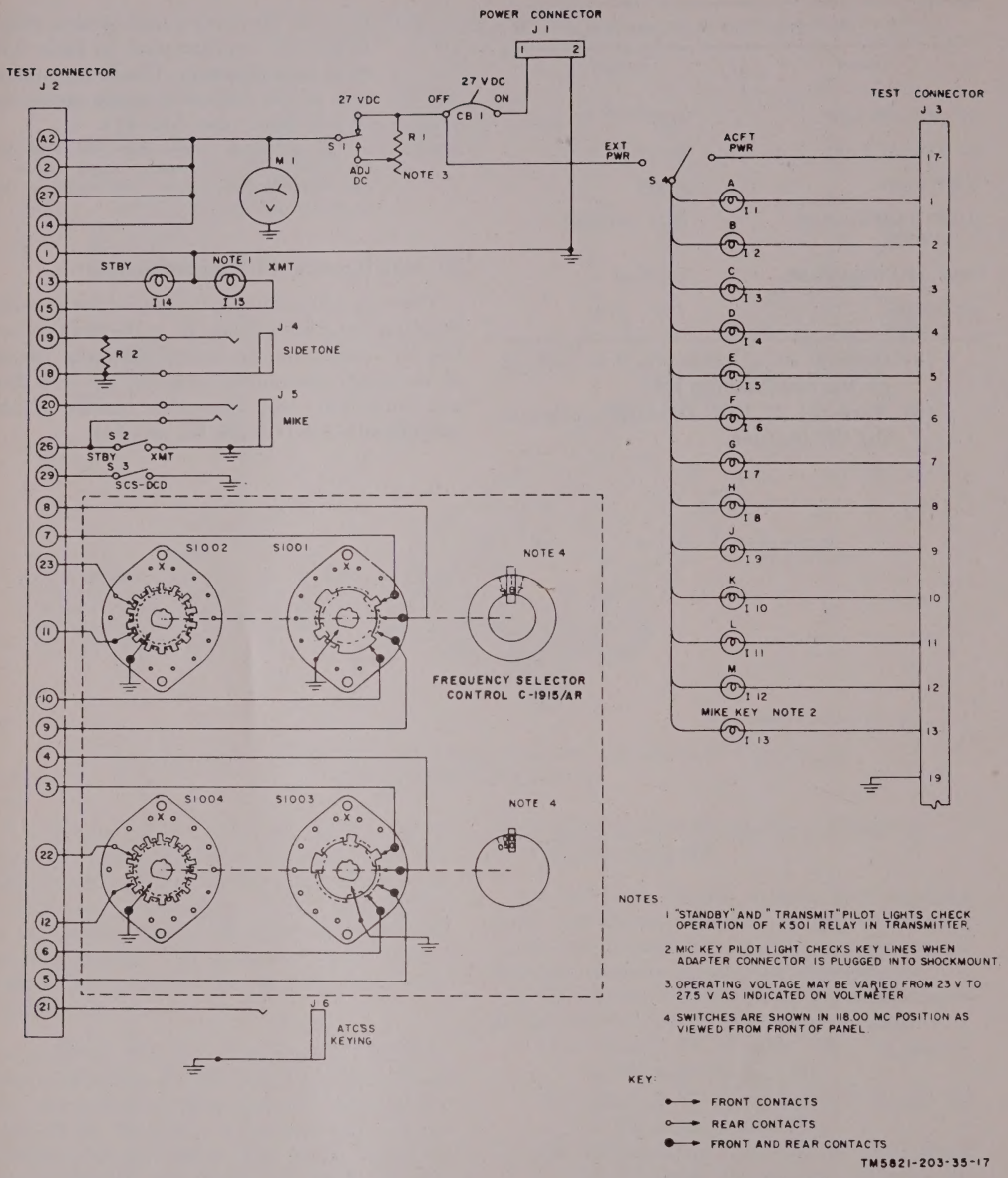


Figure 26. Electronic Equipment Maintenance Kit MK-430/ART, schematic diagram.

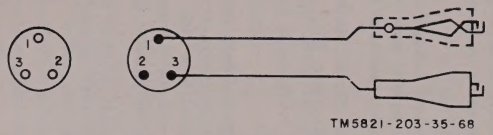


Figure 27. Cable assembly No. 1, schematic diagram.

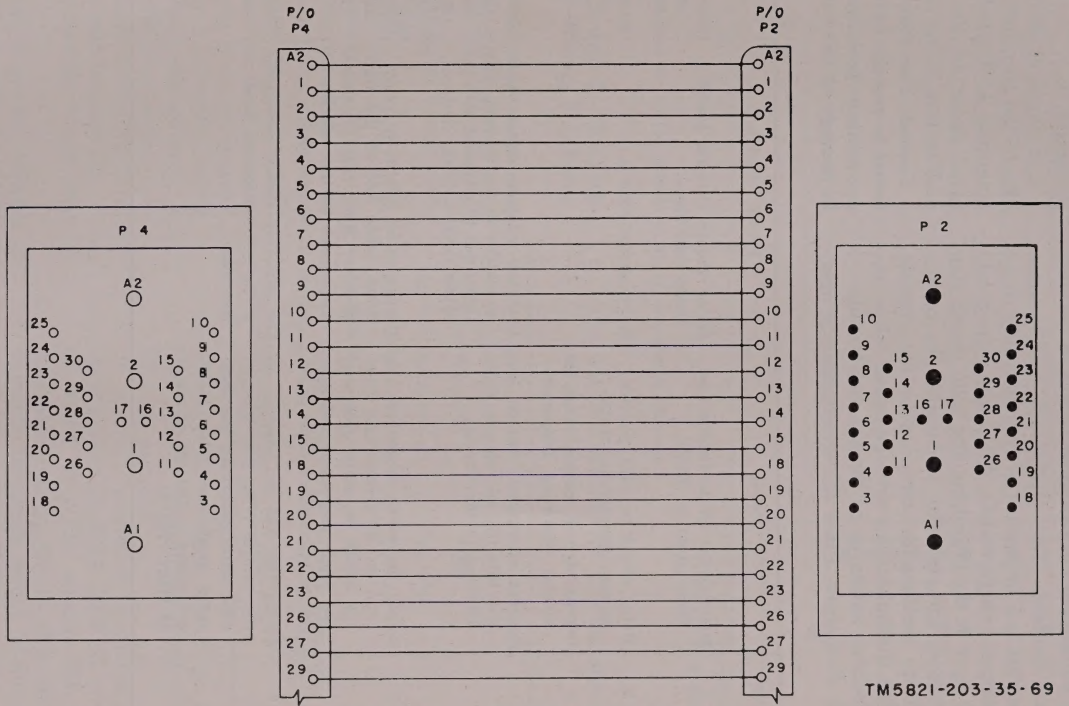


Figure 28. Cable assembly No. 2, schematic diagram.

Caution: **Do not attempt removal or replacement of parts before reading the instructions in paragraph 58.**

51. Equipment Performance Check in Aircraft

a. General. The equipment performance checklist is a procedure to systematically check equipment performance. When using the checklist start at the beginning and follo weach step in order. The checklist will enable the repairmen to sectionalize and localize the trouble. When the indications are abnormal, follow the corrective measures to remedy the trouble.

b. Procedure. Place the transmitter in operation by applying power and allow the transmitter about 2 minutes to warm up. Operate the equipment as indicated in the checklist below. (For auxiliary power unit connections, refer to paragraph 9*a*.)

c. Equipment Performance Checklist. Troubles in the transmitter will be indicated by an abnormal ANT current indication on the front panel meter, by the absence of sidetone, or a malfunction of the Autopositioner system.

Caution: **The transmitter should not be allowed to remain keyed for periods longer than one minute; prolonged transmissions can result in damage to the equipment.**

Step	Action	Normal indication	Corrective measures
1	Meter switch on the transmitter front panel to BATT.	Meter should indicate center scale (red line).	Check primary voltage at pin A2 of shock mount jack J504 (fig. 32). Check associated wiring.
2	Meter switch to ANT position, depress microphone button.	Meter should read 6.	Remove and check transmitter rf circuits (par. 55).
3	Repeat step 2 over a range of several operating frequencies.		
4	Depress microphone button and talk into the microphone while listening to the headset.	A strong sidetone signal should be audible in the headset. This signal can be adjusted with the SIDETONE LEVEL control.	Check headset. Check microphone. Check audio circuit at pin 20 of shock mount jack J504 (fig. 32). Remove and check transmitter and sidetone circuits (par. 55).
5	Rotate the whole megacycle selector on the control unit from 118 to 135 mc while observing the whole megacycle indicator on the transmitter front panel.	The indicator located at relay K603, below and to the right of meter M601 (fig. 2), should correspond to the selector switch in all positions.	Check channel selector control and associated circuits (par. 52).
6	Rotate the 0.05 mc selector on the control from 0.00 through 0.95 while observing the indicator located at relay K602, above and to the left of meter of M601 (fig. 2).	The indicator should correspond to the selector switch in all positions.	Check control unit and associated circuits (par. 52).

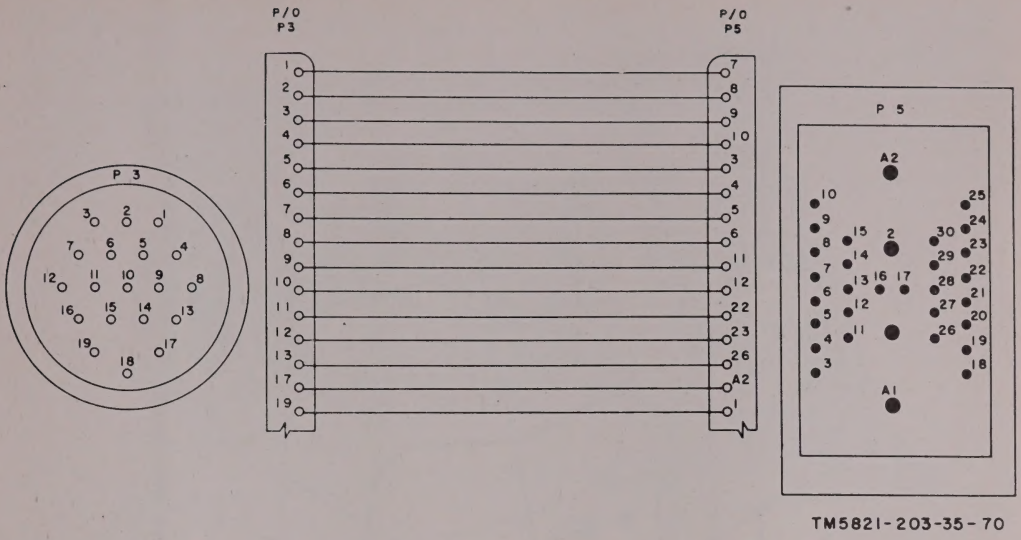


Figure 29. Cable assembly No. 3, schematic diagram.

52. Frequency Selector Control C–1915/AR and Aircraft Control Wiring, Functional Check

a. A defective control unit (or other components) may cause any of the following troubles:

(1) Autopositioner sets up on wrong channel part of the time.
(2) Autopositioner sets up on some channels, runs continuously on others.
(3) Autopositioner does not set up on any channels, stopwheel turns freely, and relay remains energized continuously.
(4) Autopositioner sets up, then recycles.
(5) Autopositioner relay does not operate.

b. To determine whether a defective control unit, or control wiring within the aircraft, is causing one of the above troubles, either substitute a known good transmitter or perform the following test with the maintenance kit.

(1) Remove the transmitter from the shock mount.
(2) If aircraft 27.5-volt dc power is available, connect P3 of cable No. 3 to jack J3 on the maintenance kit (fig. 25). If aircraft power is not available, connect P1 of cable No. 1 to jack J1 on the maintenance kit.
(3) Set the controls of the maintenance kit as follows:

Control	Position
27 VDC ON-OFF	OFF
27 VDC-ADJ DC	27 VDC
XMT-STBY	STBY
DCD-SCS	SCS
ACFT POWER-EXT POWER	Either position (see (5) below.)
VHF TRANSMITTER	118.0 mc

(4) Connect P5 of cable No. 3 to jack J504 on the transmitter shock mount (fig. 25 and 32).
(5) If aircraft power is available, set ACFT POWER-EXT POWER switch to ACFT POWER; operate the aircraft controls to supply 27.5-volt dc power to the shock mount. If aircraft power is not available, connect the clip end of cable No. 1 to a 27.5-volt dc source, observing polarity (red clip is positive); then set the 27 VDC ON-OFF switch on the maintenance

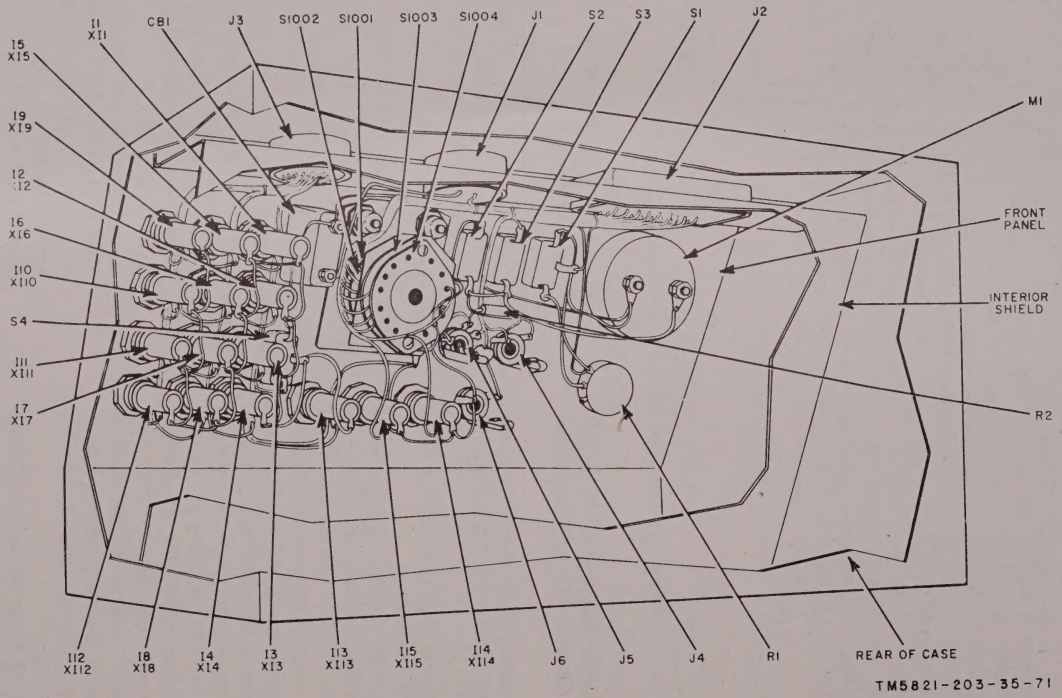


Figure 30. Electronic Equipment Maintenance Kit MK-430/ART, pictorial diagram, parts location.

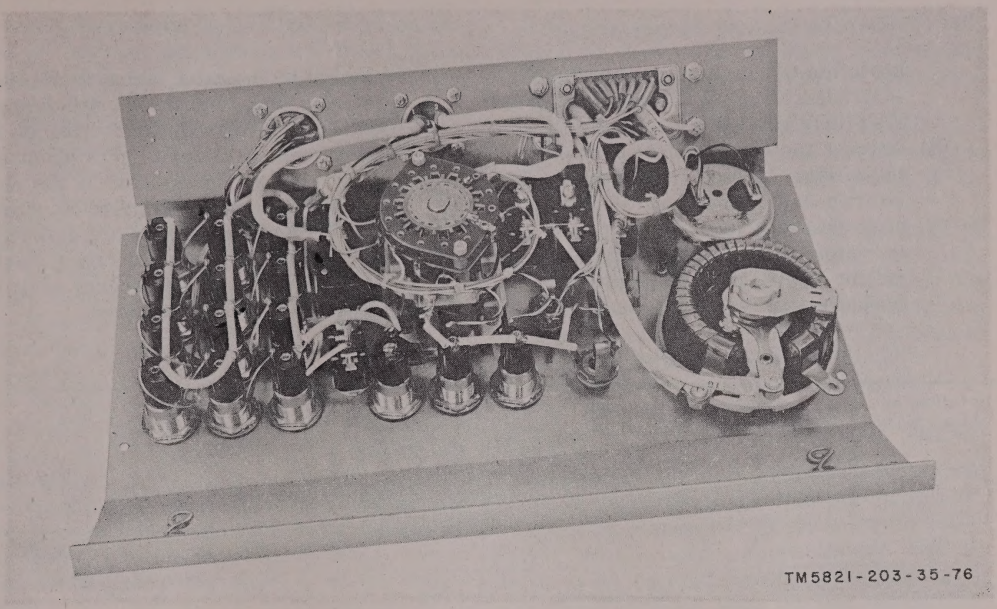


Figure 31. Electronic Equipment Maintenance Kit MK-430/ART, inside view.

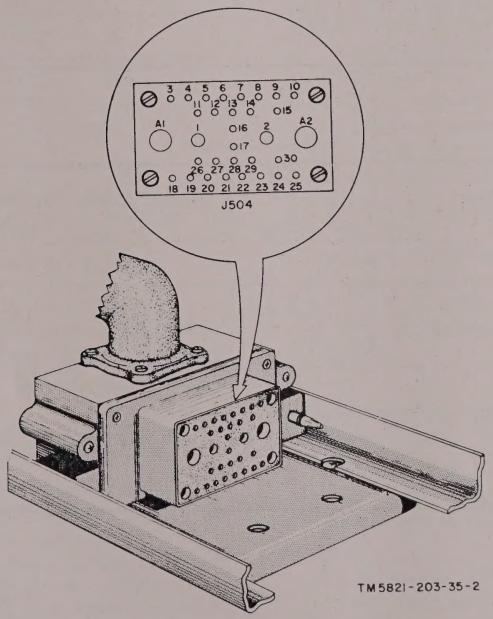


Figure 32. Transmitter shock-mount jack.

kit to the ON position and the ACFT POWER-EXT POWER switch to the EXT POWER position.

(6) Operate the control unit *mounted in the aircraft* to each whole megacycle position and then to each 0.05 megacycle position; note the operation of indicator lamps A through M. The indicator lamps should operate in accordance with the chart below. Failure of the indicator lamps to operate in accordance with the chart indicates either defective aircraft wiring or a defective control unit. (For trouble-shooting procedures refer to the applicable aircraft configuration manual.) If lamp indications are incorrect throughout the frequency range, check to see whether the frequency control dials are incorrecty indexed.

Control unit test chart

LIGHT[a]	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135
A	X	X							X	X	X	X			X	X		
B			X	X							X	X	X	X			X	X
C					X	X							X	X	X	X		
D	X	X					X	X							X	X	X	X
J		X		X		X		X		X		X		X		X		X
M	X		X		X		X		X		X		X		X		X	

Control unit test chart

LIGHT[a]	00	05	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
E	X	X			X	X					X	X	X	X						
F			X	X			X	X					X	X	X	X				
G					X	X									X	X	X	X		
H							X	X									X	X	X	X
K		X		X		X		X		X		X		X		X		X		X
M	X		X		X		X		X		X		X		X		X		X	

[a]X indicates lights on.

(7) Operate the push-to-talk switch on the *aircraft* microphone. The MIKE KEY indicator lamp should light.

53. Radio Transmitter T–595/AR, Functional Check (fig. 24)

Note. The power source must be connected to the transmitter for all dynamic-servicing procedures; the test equipment connections will vary from test to test.

a. Connect P1 of cable assembly No. 1 to jack J1 on the maintenance kit. Connect the clips on the other end of the cable to the source of 27.5-volt dc power, observing polarity (the red clip is positive).

b. Connect plug P2 of cable assembly No. 2 to jack J2 of the maintenance kit. Connect P4 of cable No. 2 to jack P504 on the rear of the transmitter.

c. On the front panel of the maintenance kit, plug the microphone into the MIKE jack, and the headset into the SIDETONE jack.

d. Remove the front panel from the transmitter.

e. Connect the wattmeter to antenna connector J602 on the front of the transmitter.

f. Set the front panel controls of the maintenance kit (fig. 22) as follows:

Switch	Position
27 VDC ON-OFF	OFF
27 VDC-ADJ DC	27 VDC
ACFT POWER-EXT POWER	EXT POWER
DCD-SCS	SCS
VHF TRANSMITTER	118.0 mc
XMT-STBY	STBY

g. Set the 27 VDC ON-OFF switch (fig. 22) to the ON position. The following conditions will exist:

(1) The voltmeter will indicate the power supply voltage.
(2) The STBY indicator lamp will light.
(3) Channel indication on the transmitter front panel will be 118.0 mc.

Note. Whole megacycles are indicated in a window at relay K603 (fig. 2). Increments of 0.05 mc are indicated in a window at relay K602.

h. Successively set the VHF TRANSMITTER control to each whole-megacycle position and observe the channel indicator on the front panel of the transmitter.

i. Successively set the VHF TRANSMITTER control to each 0.05 mc position and observe the channel indicator on the front panel of the transmitter.

j. Decrease the power supply voltage until the maintenance kit voltmeter reads 24 volts. Change frequency several times to check the low-voltage transmitter channel cycling. Increase the power supply voltage until the maintenance kit voltmeter reads 27.5 volts.

Note. If indications are incorrect throughout the frequency range (*h*, *i*, and *j* above), check the indicator dials on the maintenance kit and the transmitter for correct indexing.

k. Set meter switch S603, located on the front panel of the transmitter, to the ANT position.

l. Key the transmitter by operating the XMT-STBY switch on the maintenance kit (fig. 22) to the XMT position. Observe the following:

(1) The XMT lamp on the maintenance kit lights.
(2) The STANDBY lamp on the maintenance kit does not light.
(3) Meter M601 on the transmitter front panel should indicate 5 scale divisions or more.
(4) The wattmeter should indicate 25 watts or more.
(5) Speak into the microphone. Sidetone should be head in the headset.

m. Return the XMT-STBY switch to the STBY position.

n. Perform the procedure *k*, *l*, and *m* above for at least three frequencies at the bottom, middle, and top of the frequency range.

o. If any malfunction is detected, refer to paragraph 55.

54. Checking Filament and B+ Circuits for Shorts

a. When to Check. When any of the following conditions apply, check for short circuits and clear the trouble before applying power to the equipment:

(1) When the transmitter is being bench serviced, and the nature of the abnormal symptoms is not known.

(2) When abnormal symptoms reported from operational tests indicate possible power-supply troubles.

b. Conditions for Tests. To prepare for the short circuit tests, perform the following steps:

(1) Make sure no power is applied to the equipment through power control connector P504.
(2) Remove the dynamotor (par. 65).
(3) Remove the two side panels from the transmitter.
(4) Disconnect plug P503 from jack J402 (fig. 44).
(5) When checking the filament circuits, remove all tubes from their sockets.
(6) When checking the B+ circuits, replace all the tubes in their proper sockets.

c. Procedures. Make the resistance measurements indicated in the charts in *d* and *e* below. If abnormal results are obtained, make the additional isolating checks outlined. When checking a suspected capacitor for a short, disconnect one of its leads from the circuit and measure its resistance. If there is any resistance reading, the capacitor is shorted or leaky and must be replaced with a good one. If the capacitor checks normal (infinity), reconnect it before going on to the following component or step. Replace any component that is shorted, and make sure all shorts are cleared before applying power to the transmitter.

d. Checking Filament Circuits for Shorts.

Point of measurement	Normal indication	Corrective measures
From pin 10 of plug P503 to ground.	124 ohms.	Check resistors R512 and R513; each should measure 62 ohms. If the resistance varies more than 20% replace the resistor.
From pin 10 of jack J402 to ground (fig. 44).	Infinite resistance.	Check capacitors C114, C115, C417, C423, and C429 for shorts.
From pin 12 of jack J402 to ground.	Infinite resistance.	Check Capacitors C427 and C435 for shorts.
From pin 12 of plug P503 to ground.	Infinite resistance.	Check capacitors C301 and C302 for shorts.
From pin 13 of plug P503 to ground.	Infinite resistance.	Check capacitors C109 and C110 for shorts.
From pin 13 of jack J402 to ground.	Infinite resistance.	Check capacitors C208, C209, C351, C357, C402, and C406 for shorts.
From pin 15 of jack J402 to ground.	Infinite resistance.	Check capacitors C416 and C449 for shorts.
From pin 4 of tube socket XV301 or pin 3 of tube socket XV302 to ground.	Infinite resistance.	Check capacitors C303, C314, and C327, for shorts.
From pin 4 of tube socket XV302 or pin 3 of tube socket XV303 to ground.	Infinite resistance.	Check capacitors C328 and C350 for shorts.
From pin 4 of tube socket XV404 or XV403 to ground (fig. 44).	Infinite resistance.	Check capacitors C428 and C430 for shorts.
From pin 5 of tube socket XV405 to ground.	Infinite resistance.	Check for shorted capacitor C441.

e. Checking B+ Circuits for Shorts.

Point of measurement	Normal indication	Corrective measures
From pin 8 of jack J501 to ground (fig. 58).	Infinite resistance.	Remove the plate leads from modulator tubes V503 and V504 and both sections of power amplifier V405. If removing a lead from a tube causes normal resistance to occur, replace the tube. Remove the wiring from terminal 2 of T503 and measure the resistance from terminal 2 to ground. If there is a reading to ground, replace the transformer.

Point of measurement	Normal indication	Corrective measures
From pin 14 of jack J402 to ground (fig. 44).	Infinite resistance.	Remove power amplifier tube V405. If the resistance becomes normal, replace V405 with a good tube. Check capacitor C440 for short.
From pin 7 of jack J402 to ground.	Infinite resistance.	Remove tubes V401 through V404 and check them for internal shorts. If the resistance is greater than 22K ohms, check capacitors C409, C431, and C432 for shorts. If the resistance is greater than 8,000 ohms, check capacitor C410 for short. If the resistance is greater than 3,000 ohms, check capacitor C418 for short. If the resistance is less than 3,000 ohms, check capacitors C412, C419, C422, C434, C445, C446, and C447 for shorts.
From pin 7 of plug P503 to ground.	Infinite resistance.	If the resistance reading is greater than 30K ohms, disconnect and check capacitors C331, C502, C503, and C353 for shorts. If the reading is greater than 20K ohms, check tube V301 or capacitors C305 and C308 for shorts. If the reading is greater than 4,000 ohms, check tubes V101 and V201 or capacitors C104, C204, and C507 for shorts.
		Disconnect the wiring from terminal 6 of transformer T503 and measure the resistance to ground. If there is a reading other than infinity, replace the transformer. If the resistance is greater than 1,200 ohms, check tubes V302 and V303 for internal shorts. If the tubes are not the cause of trouble, check capacitors C111, C112, C113, C210, C211, C212, C315, C326, C335, C352, C355, and C505 for shorts. If the resistance is greater than 750 ohms, check tubes V501 and V502 or capacitor C504 for shorts. If the short remains, disconnect the wiring from terminal 1 of transformer T504 and terminal 2 of transformer T502. Measure the resistance from these terminals to ground. If either of the transformers shows a resistance reading other than infinity, replace the transformer.

55. Localizing Troubles

a. General. Procedures are outlined in *d* and *e* below for localizing troubles in the rf and af sections of the transmitter, and for localizing troubles to a stage within either of these two sections. When use of the procedures results in localization of trouble to a particular stage, use the techniques outlined in paragraphs 56 and 57 to isolate the trouble to a particular part.

b. Use of Diagrams. The two troubleshooting diagrams supplement the operational checks

detailed in the equipment performance checklist (par. 51). If previous operational checks have resulted in reference to a particular item of this diagram, go directly to the referenced item.

Caution: **If operational symptoms are not known, or they indicate the possibility of short circuits within the transmitter, make the short-circuit checks described in paragraph 54 before applying power to the unit.**

c. Conditions for Tests. All checks outlined in the charts are to be bench conducted with the transmitter connected to the maintenance kit.

(1) Connect the clip leads of cable No. 1 (fig. 23) to a 27.5-volt dc power source; observe the polarity of the leads. (The red clip is positive.) Connect the other end (P1) of the same cable to jack J1 on the maintenance kit.

(2) Connect P2 of cable No. 2 to jack on the maintenance kit. Connect the other end (P4) of the same cable to P504 on the transmitter.

(3) Set the controls on the maintenance kit as follows:

Control	Position
27 VDC ON-OFF	OFF
27 VDC-ADJ DC	27 VDC
XMT-STBY	STBY
DCD-SCS	SCS
AFT POWER-EXT POWER	EXT POWER
VHF TRANSMITTER	118.0 mc

d. Rf Section Troubleshooting. Trouble in the rf section of the transmitter may be localized by observing the front panel meter indications for all meter switch positions and making voltage measurements at two test points in the frequency generator subassembly. The following chart shows the normal meter indication for each switch position when the transmitter is operated by setting the maintenance kit XMT-STBY in XMT position. Follow the procedures given in the troubleshooting diagram (fig. 33) to localize the trouble. After trouble has been localized to a circuit within the rf section, the tube should be checked and, if the tube is normal, voltage and resistance measurements (par. 57) should be taken. If all checks indicate that alignment of a stage is necessary, refer to paragraphs 81 through 84 for alignment procedures.

Front panel meter, normal indications

Switch positions	Meter indication
ANT	6
BAT	To red line in center of scale.
I_K PA	7.5
I_G PA	5
I_G DR	3.5
I_G AMP	1
I_G TRIP	6

e. Audio Section Troubleshooting. Trouble in the audio section of the transmitter may be localized by listening to the sidetone signal and checking the modulation with a very-high frequency (vhf) receiver. Figure 34 is a troubleshooting diagram for the audio section. After trouble has been localized to a circuit within the audio section, the tube should be checked and then voltage and resistance measurements taken (par. 57). If all checks indicate that the modulation and sidetone controls need adjustment, refer to paragraphs 76 and 77 for adjustment procedures.

56. Isolating Troubles Within Stage

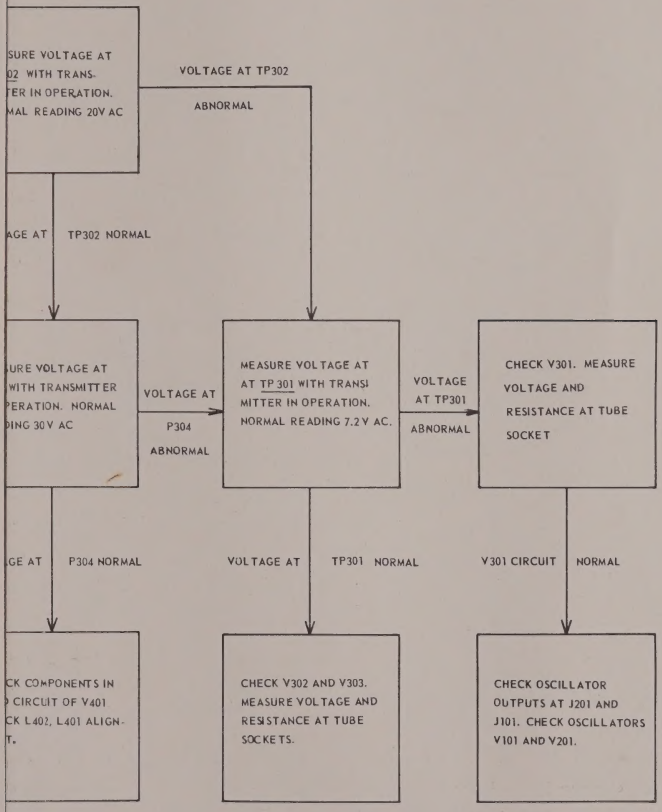
When trouble has been localized to a stage, use the following techniques to isolate the defective part:

a. Test the tube involved, either in the tube tester or by substituting the same type tube which is known to be operating normally.

b. Take voltage measurements (par. 57) at the tube sockets.

c. If voltage readings are abnormal, take resistance readings (par. 57) to isolate open and short circuits.

d. Use the overall schematic diagram (fig. 66) to circuit trace and isolate the faulty component.



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detailed in the equipment performance checklist (par. 51). If previous operational checks have resulted in reference to a particular item of this diagram, go directly to the referenced item.

Caution: **If operational symptoms are not known, or they indicate the possibility of short circuits within the transmitter, make the short-circuit checks described in paragraph 54 before applying power to the unit.**

c. Conditions for Tests. All checks outlined in the charts are to be bench conducted with the transmitter connected to the maintenance kit.

(1) Connect the clip leads of cable No. 1 (fig. 23) to a 27.5-volt dc power source; observe the polarity of the leads. (The red clip is positive.) Connect the other end (P1) of the same cable to jack J1 on the maintenance kit.

(2) Connect P2 of cable No. 2 to jack on the maintenance kit. Connect the other end (P4) of the same cable to P504 on the transmitter.

(3) Set the controls on the maintenance kit as follows:

Control	Position
27 VDC ON-OFF	OFF
27 VDC-ADJ DC	27 VDC
XMT-STBY	STBY
DCD-SCS	SCS
AFT POWER-EXT POWER	EXT POWER
VHF TRANSMITTER	118.0 mc

d. Rf Section Troubleshooting. Trouble in the rf section of the transmitter may be localized by observing the front panel meter indications for all meter switch positions and making voltage measurements at two test points in the frequency generator subassembly. The following chart shows the normal meter indication for each switch position when the transmitter is operated by setting the maintenance kit XMT-STBY in XMT position. Follow the procedures given in the troubleshooting diagram (fig. 33) to localize the trouble. After trouble has been localized to a circuit within the rf section, the tube should be checked and, if the tube is normal, voltage and resistance measurements (par. 57) should be taken. If all checks indicate that alignment of a stage is necessary, refer to paragraphs 81 through 84 for alignment procedures.

Front panel meter, normal indications

Switch positions	Meter indication
ANT	6
BAT	To red line in center of scale.
I_K PA	7.5
I_G PA	5
I_G DR	3.5
I_G AMP	1
I_G TRIP	6

e. Audio Section Troubleshooting. Trouble in the audio section of the transmitter may be localized by listening to the sidetone signal and checking the modulation with a very-high frequency (vhf) receiver. Figure 34 is a troubleshooting diagram for the audio section. After trouble has been localized to a circuit within the audio section, the tube should be checked and then voltage and resistance measurements taken (par. 57). If all checks indicate that the modulation and sidetone controls need adjustment, refer to paragraphs 76 and 77 for adjustment procedures.

56. Isolating Troubles Within Stage

When trouble has been localized to a stage, use the following techniques to isolate the defective part:

a. Test the tube involved, either in the tube tester or by substituting the same type tube which is known to be operating normally.

b. Take voltage measurements (par. 57) at the tube sockets.

c. If voltage readings are abnormal, take resistance readings (par. 57) to isolate open and short circuits.

d. Use the overall schematic diagram (fig. 66) to circuit trace and isolate the faulty component.

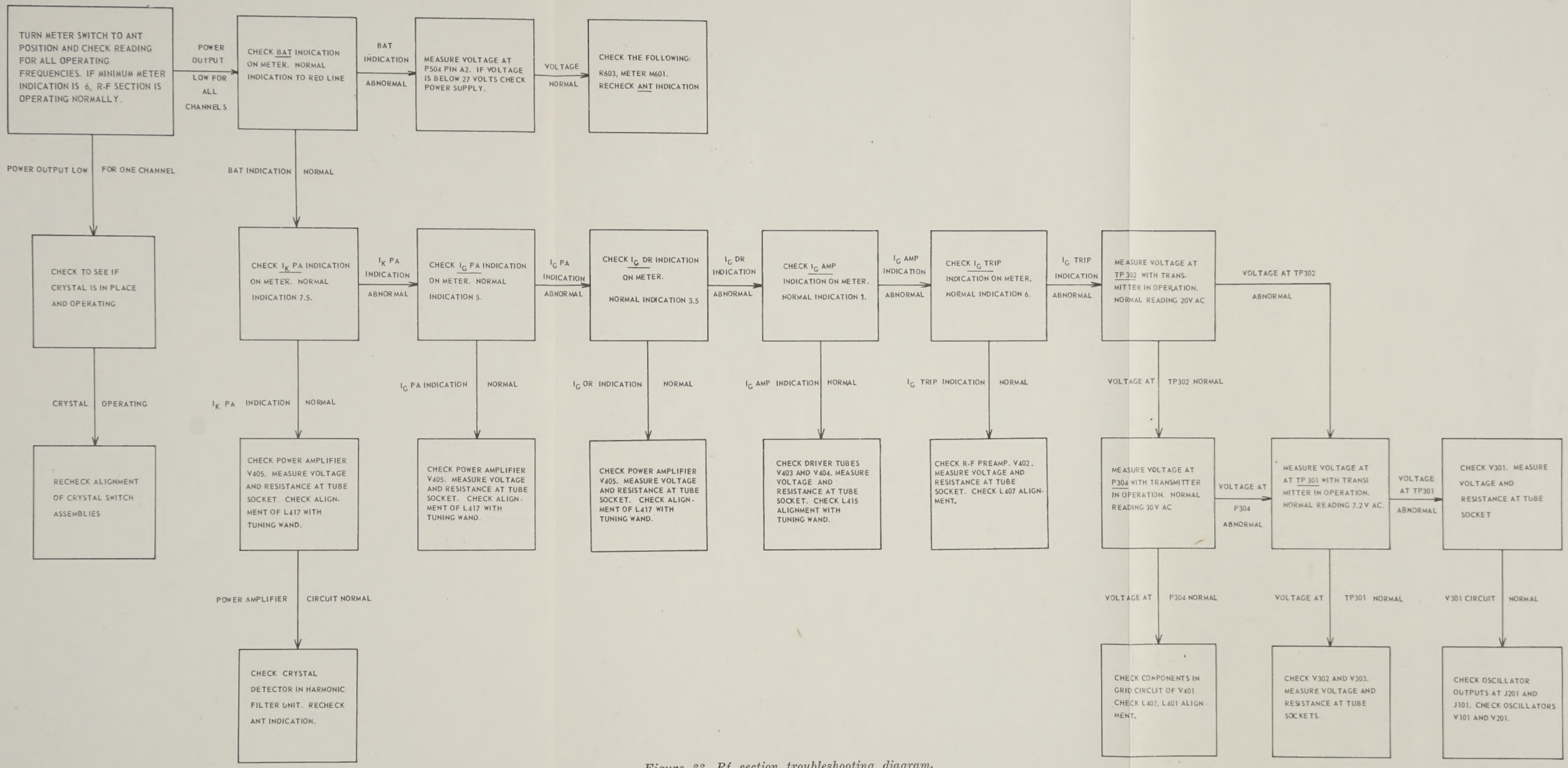
TURN METER SWITCH TO ANT POSITION AND CHECK READING FOR ALL OPERATING FREQUENCIES. IF MINIMUM METER INDICATION IS 6, R-F SECTION IS OPERATING NORMALLY.
POWER OUTPUT LOW FOR ALL CHANNELS
CHECK BAT INDICATION ON METER. NORMAL INDICATION TO RED LINE
BAT INDICATION ABNORMAL
MEASURE VOLTAGE AT P504 PIN A2. IF VOLTAGE IS BELOW 27 VOLTS CHECK POWER SUPPLY.
VOLTAGE NORMAL
CHECK THE FOLLOWING: R603, METER M601. RECHECK ANT INDICATION
POWER OUTPUT LOW FOR ONE CHANNEL
CHECK TO SEE IF CRYSTAL IS IN PLACE AND OPERATING
CRYSTAL OPERATING
RECHECK ALIGNMENT OF CRYSTAL SWITCH ASSEMBLIES
BAT INDICATION NORMAL
CHECK I_K PA INDICATION ON METER. NORMAL INDICATION 7.5.
I_K PA INDICATION ABNORMAL
CHECK I_G PA INDICATION ON METER. NORMAL INDICATION 5.
I_G PA INDICATION ABNORMAL
CHECK I_G DR INDICATION ON METER. NORMAL INDICATION 3.5
I_G DR INDICATION ABNORMAL
CHECK I_G AMP INDICATION ON METER. NORMAL INDICATION 1.
I_G AMP INDICATION ABNORMAL
CHECK I_G TRIP INDICATION ON METER. NORMAL INDICATION 6.
I_G TRIP INDICATION ABNORMAL
MEASURE VOLTAGE AT TP302 WITH TRANSMITTER IN OPERATION. NORMAL READING 20V AC
VOLTAGE AT TP302 ABNORMAL
I_K PA INDICATION NORMAL
CHECK POWER AMPLIFIER V405. MEASURE VOLTAGE AND RESISTANCE AT TUBE SOCKET. CHECK ALIGNMENT OF L417 WITH TUNING WAND.
POWER AMPLIFIER CIRCUIT NORMAL
CHECK CRYSTAL DETECTOR IN HARMONIC FILTER UNIT. RECHECK ANT INDICATION.
I_G PA INDICATION NORMAL
CHECK POWER AMPLIFIER V405. MEASURE VOLTAGE AND RESISTANCE AT TUBE SOCKET. CHECK ALIGNMENT OF L417 WITH TUNING WAND.
I_G OR INDICATION NORMAL
CHECK POWER AMPLIFIER V405. MEASURE VOLTAGE AND RESISTANCE AT TUBE SOCKET. CHECK ALIGNMENT OF L417 WITH TUNING WAND.
I_G AMP INDICATION NORMAL
CHECK DRIVER TUBES V403 AND V404. MEASURE VOLTAGE AND RESISTANCE AT TUBE SOCKET. CHECK L415 ALIGNMENT WITH TUNING WAND.
I_G TRIP INDICATION NORMAL
CHECK R-F PREAMP. V402. MEASURE VOLTAGE AND RESISTANCE AT TUBE SOCKET. CHECK L407 ALIGNMENT.
VOLTAGE AT TP302 NORMAL
MEASURE VOLTAGE AT P304 WITH TRANSMITTER IN OPERATION. NORMAL READING 30 V AC
VOLTAGE AT P304 ABNORMAL
MEASURE VOLTAGE AT AT TP301 WITH TRANSMITTER IN OPERATION. NORMAL READING 7.2 V AC.
VOLTAGE AT TP301 ABNORMAL
CHECK V301. MEASURE VOLTAGE AND RESISTANCE AT TUBE SOCKET
VOLTAGE AT P304 NORMAL
CHECK COMPONENTS IN GRID CIRCUIT OF V401 CHECK L402, L401 ALIGNMENT.
VOLTAGE AT TP301 NORMAL
CHECK V302 AND V303. MEASURE VOLTAGE AND RESISTANCE AT TUBE SOCKETS.
V301 CIRCUIT NORMAL
CHECK OSCILLATOR OUTPUTS AT J201 AND J101. CHECK OSCILLATORS V101 AND V201.

Figure 33. Rf section troubleshooting diagram.

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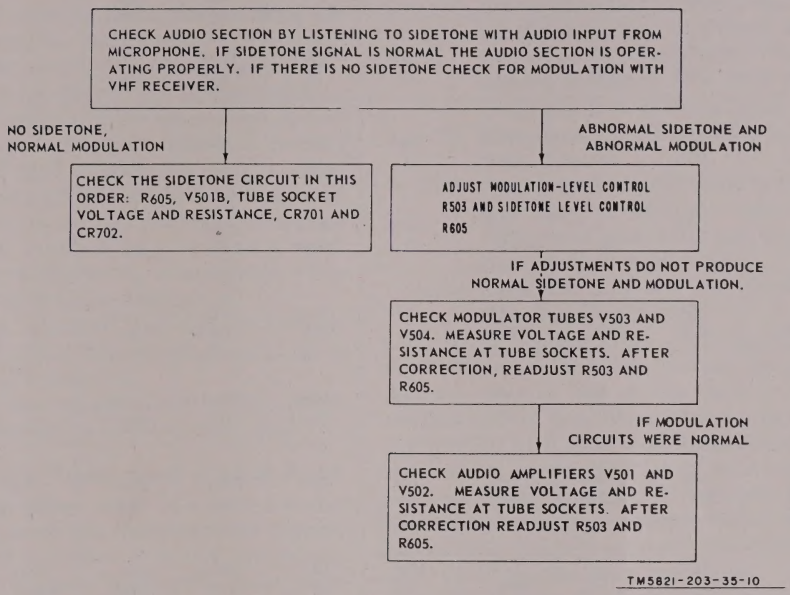
CHECK AUDIO SECTION BY LISTENING TO SIDETONE WITH AUDIO INPUT FROM MICROPHONE. IF SIDETONE SIGNAL IS NORMAL THE AUDIO SECTION IS OPERATING PROPERLY. IF THERE IS NO SIDETONE CHECK FOR MODULATION WITH VHF RECEIVER.
NO SIDETONE, NORMAL MODULATION
ABNORMAL SIDETONE AND ABNORMAL MODULATION
CHECK THE SIDETONE CIRCUIT IN THIS ORDER: R605, V501B, TUBE SOCKET VOLTAGE AND RESISTANCE, CR701 AND CR702.
ADJUST MODULATION-LEVEL CONTROL R503 AND SIDETONE LEVEL CONTROL R605
IF ADJUSTMENTS DO NOT PRODUCE NORMAL SIDETONE AND MODULATION.
CHECK MODULATOR TUBES V503 AND V504. MEASURE VOLTAGE AND RESISTANCE AT TUBE SOCKETS. AFTER CORRECTION, READJUST R503 AND R605.
IF MODULATION CIRCUITS WERE NORMAL
CHECK AUDIO AMPLIFIERS V501 AND V502. MEASURE VOLTAGE AND RESISTANCE AT TUBE SOCKETS. AFTER CORRECTION READJUST R503 AND R605.
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Figure 34. Audio section troubleshooting diagram.

e. If signals are weak and all checks fail to indicate a defective part, the transmitter must be aligned (par. 81–84).

57. Voltage and Resistance Measurements

The chart below lists the alternating-current (ac) voltages, dc voltages, and resistance at the pins of each tube within the transmitter.

Note. All resistance measurements are made from pin to ground with the dynamotor unplugged. The dc voltage measurements are made with normal power output and no modulation.

Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V101 (fig. 39):									
Dc volts	−4.0	6.5	12.6	6.3	170.0	178	6.5		
Resistance	68K	560	15	6	Inf	Inf	560		
V201 (fig. 42):									
Dc volts	−17.0	6.1	0	6.3	185.0	178.0	6.1		
Resistance	68K	560	0	6	Inf	Inf	560		
V301 (fig. 48):									
Dc volts	−15.0	1.6	18.8	25.5	98.0	98.0	1.6		
Resistance	27K	400	16	4	Inf	Inf	400		
V302:									
Dc volts	0.0	3.2	18.8	12.6	180.0	125.0	3.2		
Resistance	50	400	10	12	Inf	Inf	400		
V303:									
Dc volts	−22.0	2.7	12.6	6.3	185.0	140.0	2.7		
Resistance	220K	330	15	6	Inf	Inf	330		
V401 (fig. 44):									
Dc volts	−7.0	2.0	0.0	6.3	160.0	120.0	2.0		
Resistance	34K	180	0	4	Inf ¾	Inf	180		
V402:									
Dc volts	13.0	−0.6	13.0	6.3	12.6	240.0	245	13.0	240.0
Resistance	390	23K	390	3	9	Inf	Inf	390	Inf
V403:									
Dc volts	17.0	−9.0	17.0	18.9	12.6	195.0	245	17.0	195.0
Resistance	680	15K	680	8.5	5	Inf	Inf	680	Inf
V404:									
Dc volts	17.0	−9.9	17.0	18.9	25.6	195.0	245	17.0	195.0
Resistance	680	15K	680	7	6	Inf	Inf	680	Inf
V405:								Plate Cap 1	Plate Cap 2
Dc volts	12.5	−38.0	190	27.5	18.8	−38.0	26.1	375.0	375.0
Resistance	3	8.2K	Inf	5.5	3.5	8.2K	3.6	Inf	Inf
V501 (fig. 59):									
Dc volts	115.0	0.0	3.8	12.6	25.5	210.0		5.4	18.9
Resistance	Inf	30K	1000	15	45	Inf	20K	470	10.0
V502:									
Dc volts	10.0	0.0	10.0	6.4	0.0	220.0	215.0	10.0	220.0
Resistance	330	470K	330	50	0	34K	Inf	330	Inf
V503 (fig. 56):									Cap
Dc volts	27.5	6.3	162.0	27.0	11.0	27.5	0.0	0.0	375.0
Resistance	4	1.5	Inf	4	115	4	0	0	Inf
V504:									Cap
Dc volts	27.5	12.6	162.0	27.0	11.0	27.5	6.3	0.0	375.0
Resistance	0	2.2	Inf	4	120	4	0	0	Inf

CHAPTER 4

REPAIRS AND ALIGNMENT

Section I. REPAIRS

58. General Parts Replacement Techniques

Most of the parts in Radio Transmitting Set AN/ART–34 can be reached easily and replaced without special procedures. The following precautions apply specifically to this transmitter.

a. In the rf sections of the transmitter, before a part is removed, note the position of the part and its leads. Install replacement parts in essentially the same positions as the original parts.

b. When leads must be unsoldered to remove a subassembly, tag each lead, or draw a small sketch of the wiring to the subassembly. Note the color coding and lead destination.

c. Clean the terminals and lead connections before soldering and use enough heat to make a well-soldered connection.

d. Before removing any subassemblies, check that the transmitter is tuned to 118.0 mc.

59. Removal and Replacement of Front Panel

a. The front panel must be removed to remove the slug rack, the Autopositioner system, motor B601, or to remove or repair components behind the front panel. Remove the front panel from the transmitter main chassis as follows:

(1) Check that the transmitter is tuned to 118.0 mc.

Note. After the front panel is removed, do not change the setting of the slug rack or crystal switch assemblies. If the settings are not changed, it is possible to replace the front panel without readjusting the Autopositioner wafer switches.

(2) Remove the front cover (fig. 35 and 36).

(3) Remove both side panels from the transmitter.

(4) Remove two screws from the upper left-hand corner of the front panel (fig. 37).

(5) Remove the two screws from the right-hand side of the top cover of the transmitter.

(6) Remove the four screws from the lower left-hand side of the front panel.

(7) From the bottom of the transmitter, on the right-hand side, remove the two screws near the front panel.

(8) Remove the four screws from the two connectors behind the front panel on the lower left-hand side. These connectors consist of jack J604 and plug P502, and jack J603 and plug P501.

(9) Disengage J604 from P502 and J603 from P501.

(10) From the front of the harmonic filter unit (fig. 35 and 36), remove plug P602 from jack J701 and plug P601 from jack J702 (fig. 51).

(11) Carefully pull out the front panel from the transmitter.

b. When replacing the front panel to the transmitter, be careful to position the Autopositioner cable so that it fits into the 0.05-mc oscillator miter gear assembly (fig. 54). Use a screwdriver or similar tool to position the cable into its slot as the front panel is brought into place on the transmitter. At the same time, be careful that the 1-mc Autopositioner assembly hub coupler fits correctly into the captive coupler guide on the slug mechanism camshaft (fig. 53). Replace the front panel as follows:

(1) Place the front panel on the transmitter.

(2) Replace the two screws in the upper left-hand corner of the front panel.

(3) Replace the two screws on the top right-hand side of the front panel.

(4) Replace the four screws to the lower left-hand side of the front panel.

(5) Replace the two screws to the bottom right-hand side of the transmitter, near the front panel.

(6) Connect plugs P601 and P602 to jacks J702 and J701. Both jacks are on the harmonic filter unit (fig. 51).

(7) Connect plugs P502 and P501 to jacks J604 and J603 (fig. 37) and replace the four screws that hold these connectors together.

(8) Replace the side panels to the transmitter.

(9) Replace the front panel cover.

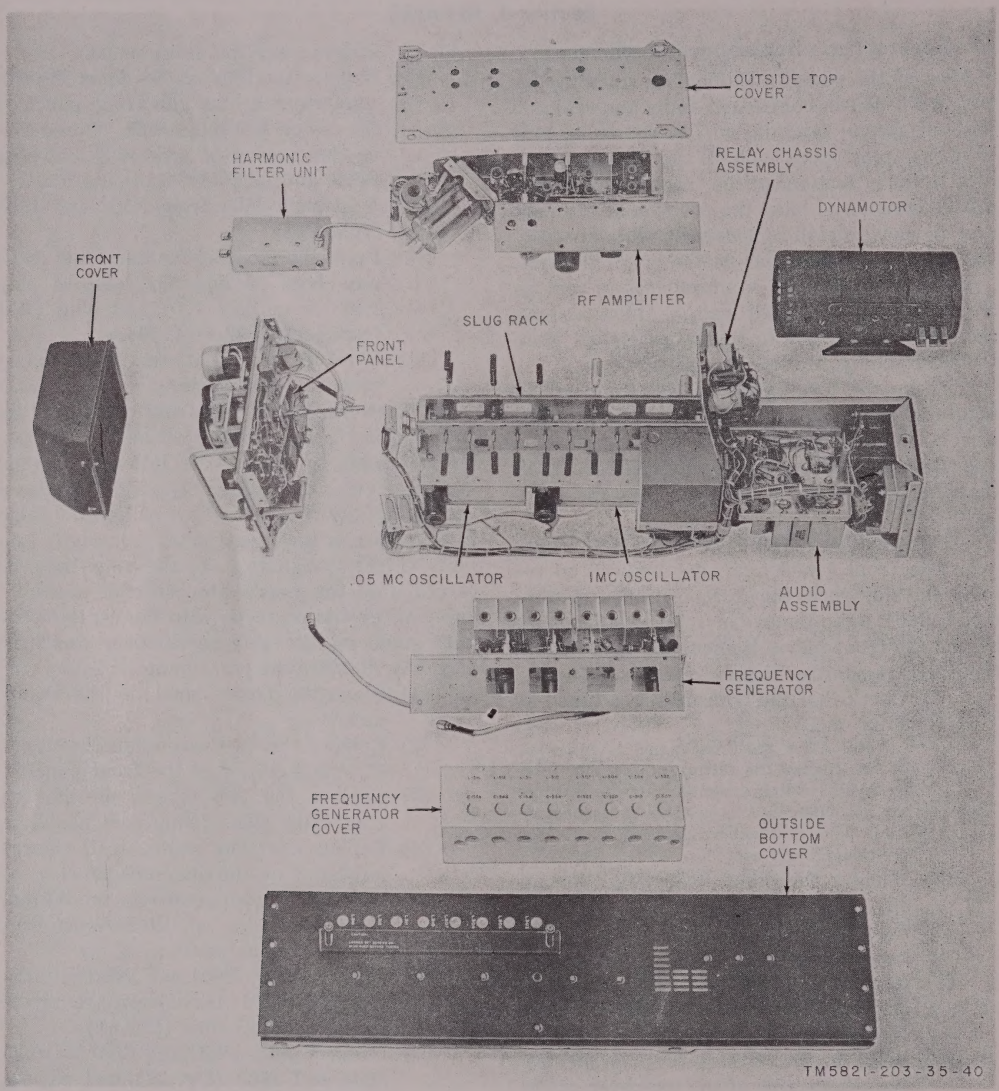


Figure 35. Radio Transmitter T–595/AR, right side view, major subassemblies.

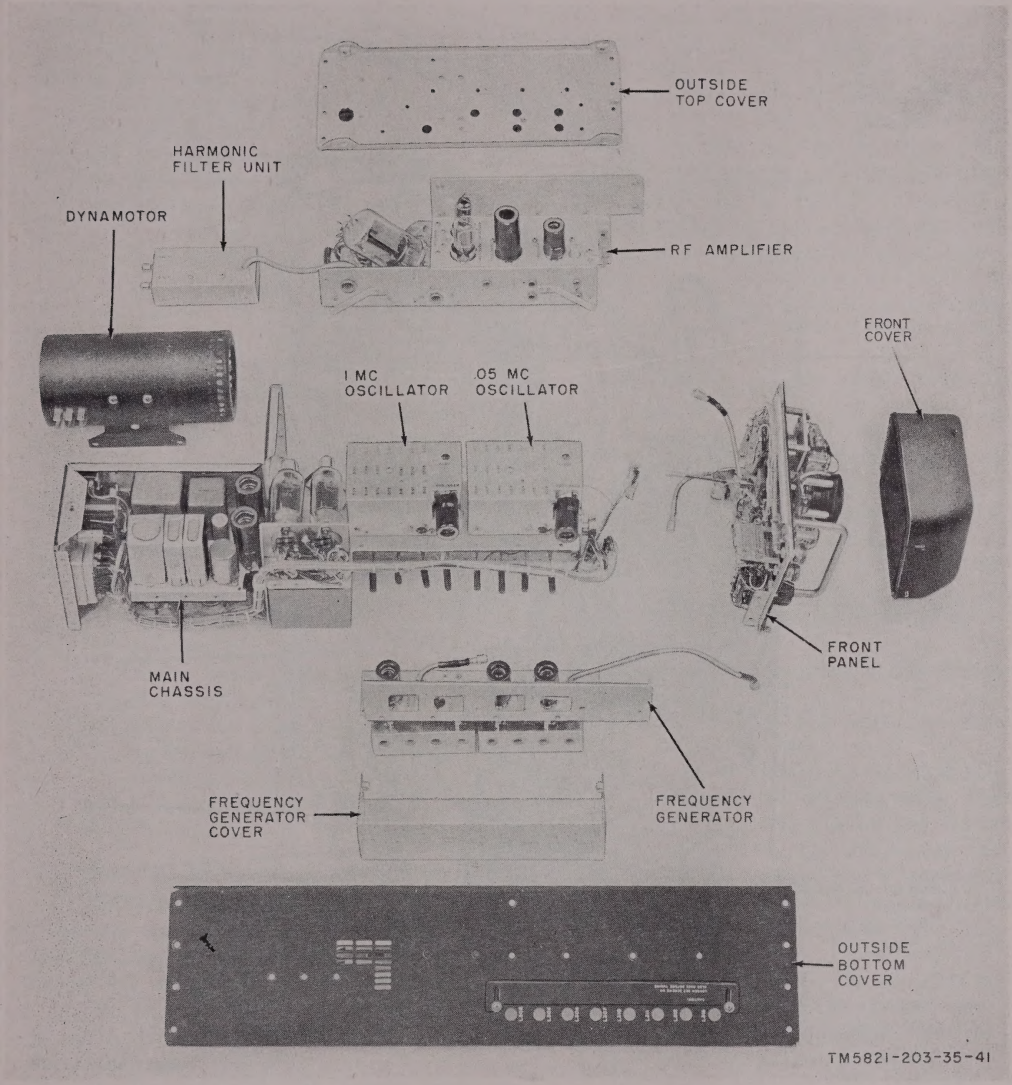


Figure 36. Radio Transmitter T–595/AR, left side view, major subassemblies.

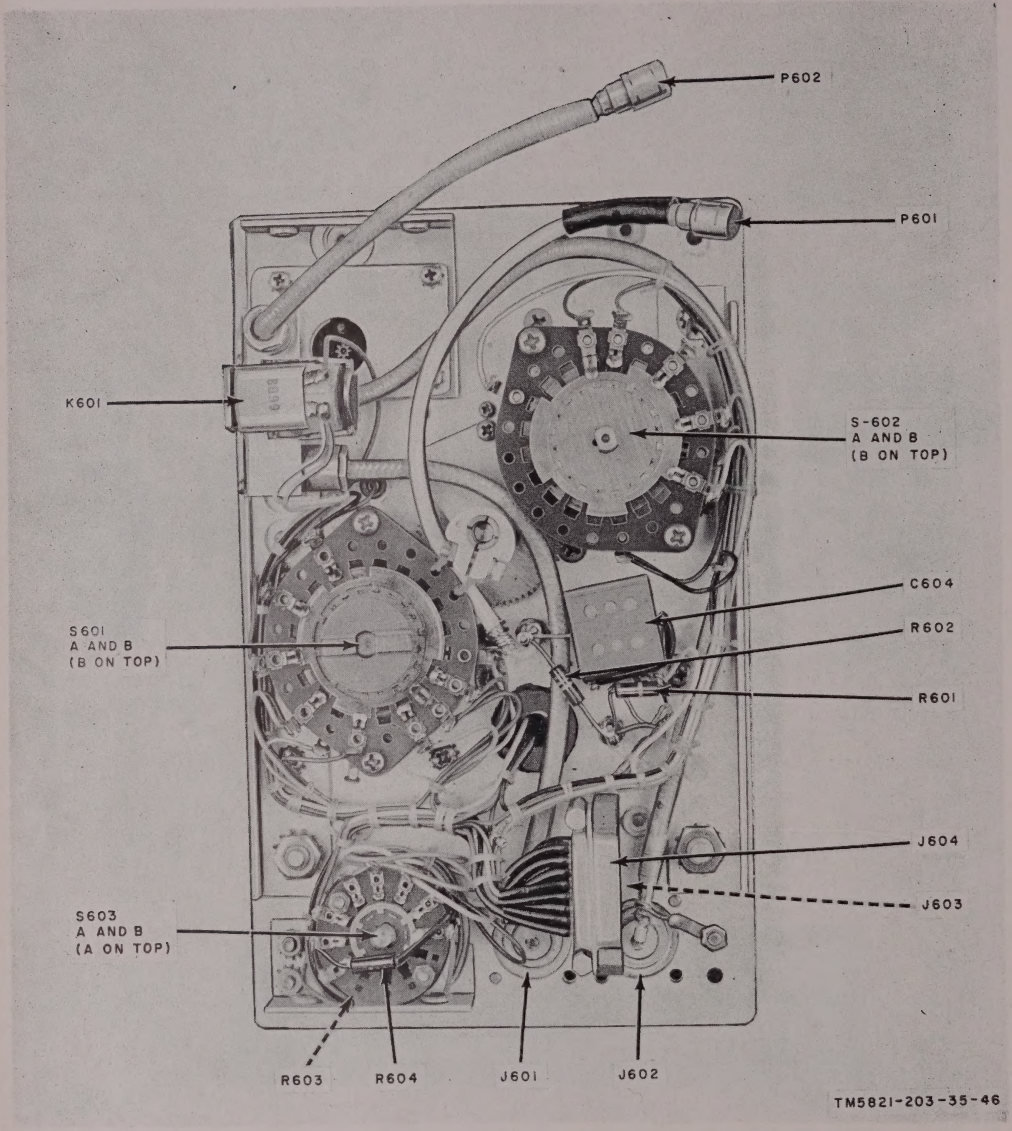


Figure 37. Front panel, rear view.

60. Removal and Replacement of 0.05–Mc Oscillator Subassembly

a. The 0.05-mc oscillator subassembly (fig. 35 and 36) must be removed to replace those components under the crystal socket board (fig. 40) or when the slug rack mechanism is to be removed. Remove the 0.05-mc oscillator subassembly, as follows:

(1) Remove both side panels from the transmitter.
(2) Disconnect plug P302 from jack J101 (fig. 38 and 39).
(3) Tag and unsolder the three wires from the two terminals on the bottom of the subassembly and the one wire on top of the subassembly.
(4) Remove the two holding screws that are directly beneath the samshaft on the slug rack side of the oscillator subassembly.
(5) Pull out the 0.05-mc oscillator subassembly.

b. Before replacing the 0.05-mc oscillator subassembly, be sure crystal selector switch S101 (fig. 38) is correctly aligned to receive the 0.05-mc miter gear shaft (3, fig. 54); then proceed as follows:

(1) Carefully replace the 0.05-mc oscillator subassembly on the main chassis.
(2) Replace the two holding screws directly beneath the camshaft on the slug rack side.
(3) Solder the wires to the two terminals on the bottom and the one terminal on top of the subassembly.
(4) Connect plug P302 to jack J101 (fig. 38 and 39).

61. Removal and Replacement of 1-Mc Oscillator Subassembly

a. The 1-mc oscillator subassembly (fig. 35 and 36) must be removed to replace components under the crystal socket board (fig. 41) or when the slug rack mechanism is to be removed. Remove the 1-mc oscillator subassembly as follows:

(1) Remove both side panels from the transmitter.
(2) Disconnect plug P301 from jack J201 (fig. 42 and 43).
(3) Tag and unsolder the wires from the two terminals on the bottom of the subassembly.
(4) Remove the two holding screws that are directly beneath the camshaft on the slug rack side of the oscillator subassembly.
(5) Pull out the 1-mc oscillator subassembly.

b. Before replacing the 1-mc oscillator subassembly (fig. 35 and 36), be sure crystal selector switch S201 (fig. 43) is correctly aligned to receive the 1-mc miter gear shaft (17, fig. 53); then proceed as follows:

(1) Carefully replace the 1-mc oscillator subassembly on the main chassis.
(2) Solder the wires to the two terminals on the bottom of the subassembly.
(3) Connect plug P301 in jack J201 (fig. 42 and 43).
(4) Replace the side panels on the transmitter.

62. Removal and Replacement of Rf Amplifier Subassembly

a. The rf amplifier subassembly (fig. 35 and 36) must be removed to replace or repair components within the subassembly (fig. 45, 46, and 47) and when the slug rack mechanism is to be removed. Remove the rf amplifier subassembly as follows:

(1) Remove the top cover from the transmitter.
(2) Unsolder the B+ lead from capacitor C443 (fig. 46).
(3) Remove the five screws that hold the subassembly to the main chassis. These screws are on the bottom of the subassembly. Three screws are reached through the subassembly. To reach the other two screws, remove power amplifier tube V405 (fig. 44, par. 63*a*).
(4) Remove the two screws from the top left-hand side of the front panel.
(5) Remove the screw that holds the subassembly to the rear panel.
(6) Disconnect plug P304 from jack J401.
(7) Remove the two screws from plug P503 and disconnect it from jack J402.
(8) On the harmonic filter unit (35E2

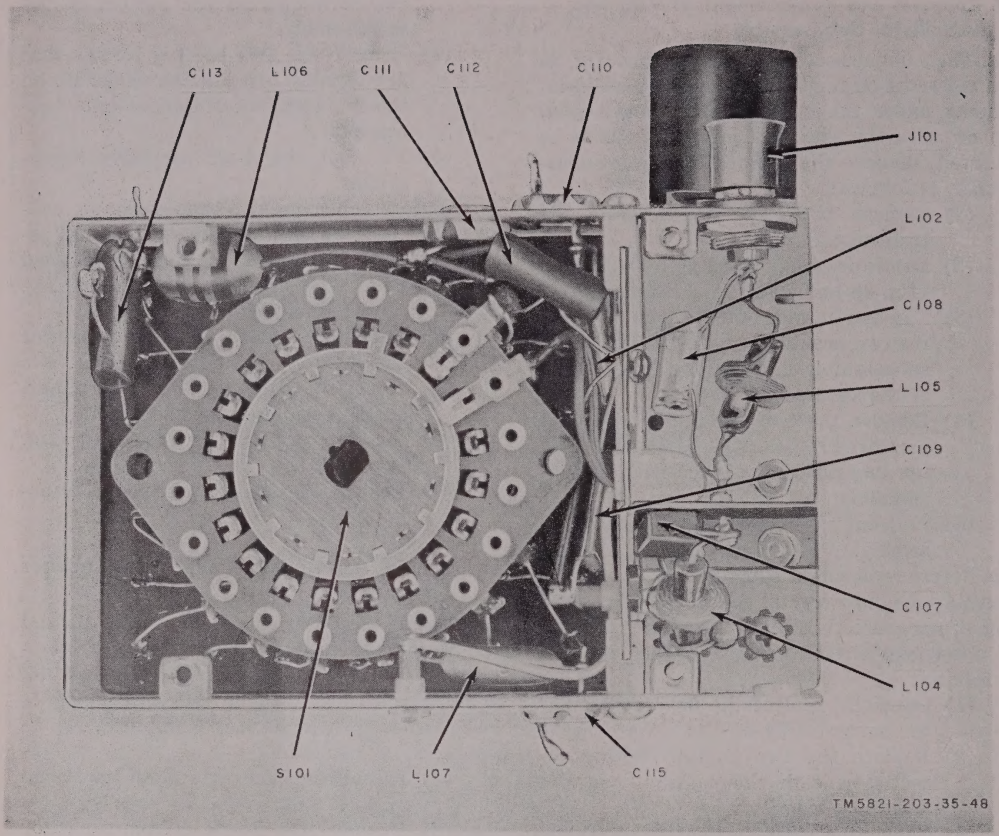


Figure 38. Oscillator subassembly, 0.05-mc, right side view.

filter), disconnect plug P601 from jack J702 and plug J602 from jack J701 (fig. 51).

(9) Remove the screw in the brace connected between the frequency generator and the rf amplifier subassemblies.

(10) To prevent damage to the tuning slugs, pull out the rf amplifier subassembly carefully (lift upward and slightly toward the front of the transmitter).

b. When replacing the rf amplifier subassembly, be especially careful that the slugs on the slug rack mechanism slip into the cores easily. Do not force the slugs because they may be damaged. Replace the rf amplifier subassembly as follows:

(1) Carefully put the rf amplifier subassembly in place on the main chassis.

(2) On the right-hand side of the subassembly, connect the brace from the frequency generator subassembly with the holddown screw.

(3) Replace the screw that holds the subassembly to the rear panel.

(4) Replace the two screws from the top left-hand side of the front panel.

(5) Replace the five screws that hold the subassembly to the main chassis.

(6) Solder the B+ lead to capacitor C443 (fig. 46).

(7) Replace power amplifier V405 (fig. 44 and par. 63*b*).

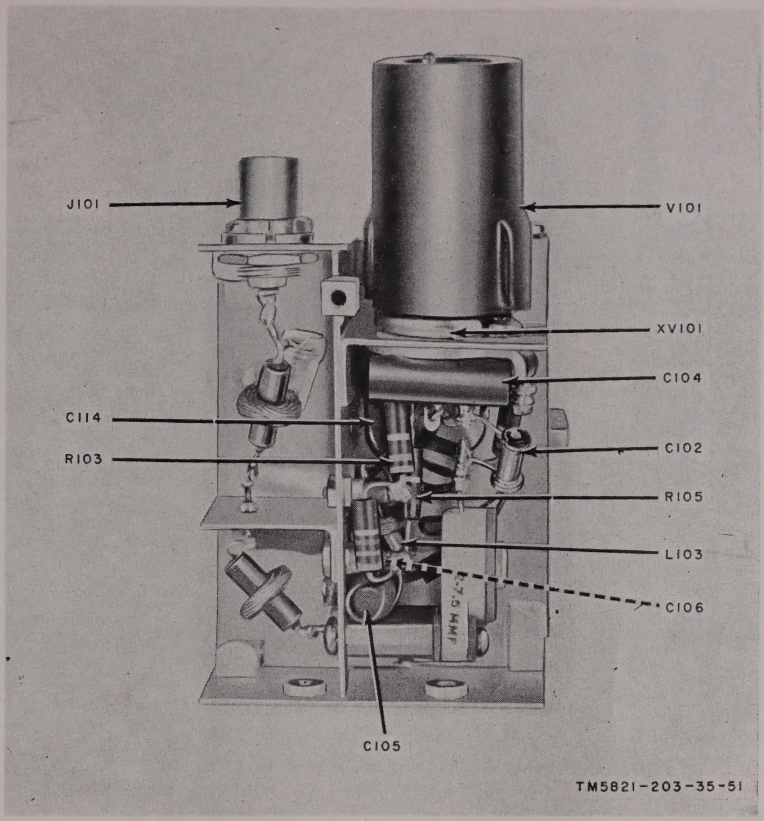


Figure 39. Oscillator subassembly, 0.05-mc, front view.

(8) Connect plug P304 to jack J401.
(9) Connect plug P503 to jack J402 and replace the two holding screws.
(10) On the harmonic filter unit, connect plug P601 to jack J702 and plug P602 to jack J701.
(11) Replace the top cover on the transmitter.

63. Removal and Replacement of Power Amplifier Tube V405

a. Power amplifier tube V405 must be removed to reach two of the five screws that hold the rf amplifier subassembly to the main chassis. Remove tube V405 as follows:

(1) Remove the clips from the plate caps.
(2) Disengage the clip from the bottom of the tube.
(3) Carefully pull out the tube.

b. Replace power amplifier tube V405 as follows:

(1) Place the tube in its socket.
(2) Engage the clip around the bottom of the tube.
(3) Replace the plate clips on the plate caps.

64. Removal and Replacement of Frequency Generator Subassembly

a. Remove the frequency generator subassembly (fig. 35 and 36) from the main chassis as follows:

(1) Remove the bottom cover and both side panels from the transmitter.
(2) Disconnect the three coaxial connectors: plug P301 from jack J201, plug P302 from jack J101, and plug P304 from jack J401 (fig. 48).

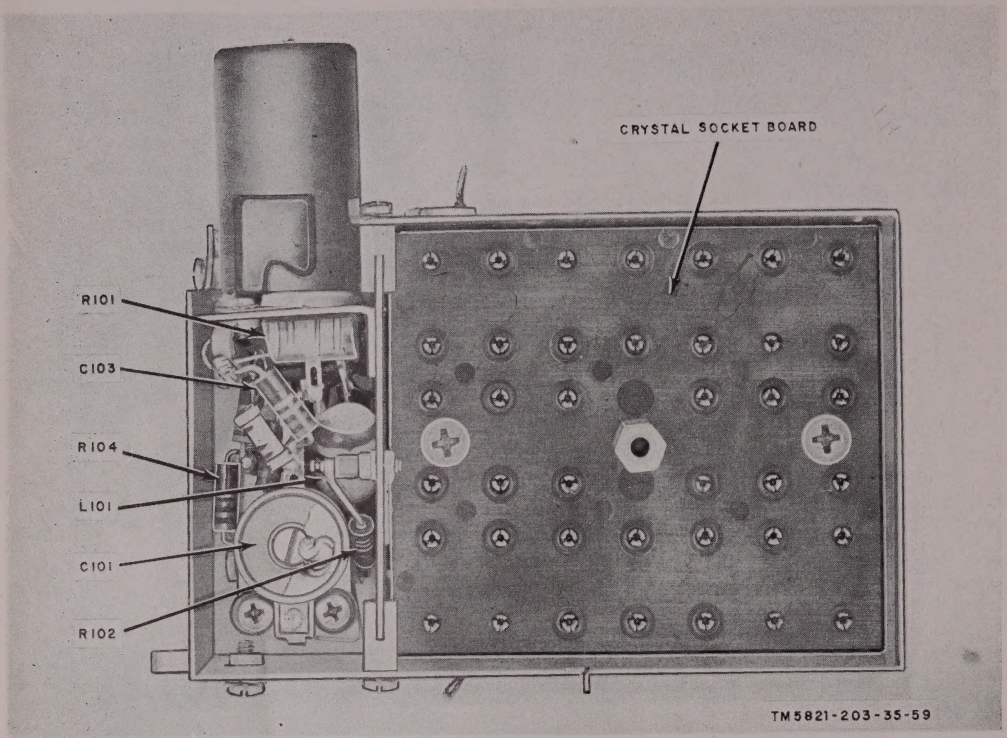


Figure 40. Oscillator subassembly, 0.05-mc, and its associated crystal socket board, left side view.

(3) Unsolder the six leads that are connected to the four feed-through capacitors C301, C357, C315, and C358 (fig. 48).
(4) Remove the six screws that hold the subassembly to the main chassis.
(5) Remove the four screws that fasten the subassembly to the front panel. These screws are on the bottom left-hand side of the front panel.
(6) Remove the screws in the brace connected to the rf amplifier subassembly.
(7) Remove the two cable clamps from the bottom of the subassembly.
(8) To prevent damage to the tuning slugs, pull out the frequency generator subassembly carefully.

b. When replacing the frequency generator subassembly to the main chasis, be sure that the slugs on the slug rack mechanism slip into the cores easily. Do not force the slugs into the cores because they may be damaged. Replace the frequency generator subassembly as follows:

(1) Carefully place the subassembly to the main chassis.
(2) Replace the four screws that fasten the subassembly to the front panel.
(3) Replace the six screws that hold the subassembly to the main chassis.
(4) Replace the screw in the brace that is connected to the rf amplifier subassembly.
(5) Replace the two cable clamps to the bottom of the frequency generator subassembly.
(6) Solder the six leads connected to feed-through capacitors C301, C357, C315, and C358 (fig. 48).
(7) Connect plug P301 to jack J201, plug P302, to jack J101, and plug P304 to

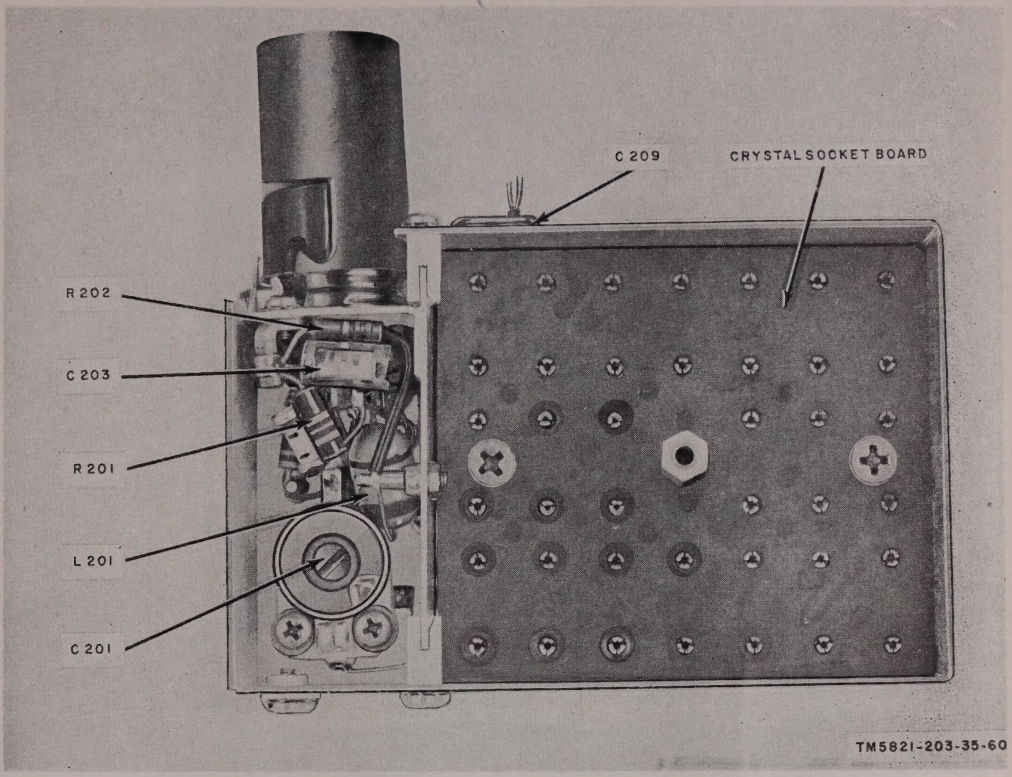


Figure 41. Oscillator subassembly, 1-mc, and its associated crystal socket board, left side view.

jack J401 (fig. 48).

(8) Replace the bottom cover and the two side panels to the transmitter.

65. Removal and Replacement of Dynamotor D501

(fig. 35 and 36)

a. Remove the dynamotor from the main chassis as follows:

(1) Remove the four screws from the base of the dynamotor.

(2) Pull the dynamotor straight up.

b. Replace the dynamotor as follows:

(1) Place dynamotor plug P505 in jack J501 on the main chassis and push straight down on the dynamotor.

(2) Replace the four holddown screws.

66. Harmonic Filter Unit

a. The harmonic filter unit (fig. 35 and 36) can be detached from the main chassis but not readily removed. Detach the unit for maintenance purposes as follows:

(1) Remove the top cover and the left side panel from the transmitter.

(2) Disconnect the two coaxial connectors: plug P602 from jack J701 and plug P601 from jack J702 (fig. 51).

(3) Remove the four flathead screws that hold the unit to the main chassis.

(4) Pull the unit out from the main chassis.

b. Attach the harmonic filter unit to the main chassis as follows:

(1) Hold the unit to the main chassis and insert the four holding screws from the top of the main chassis.

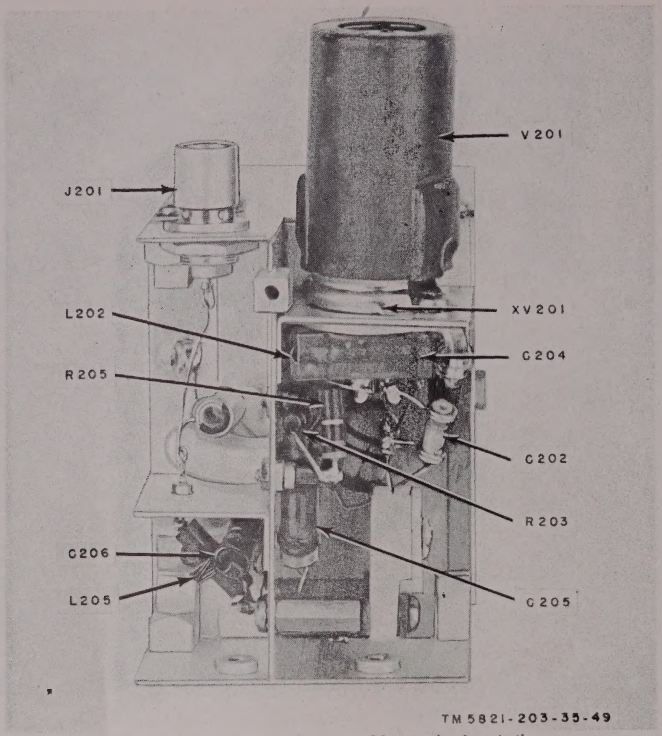


Figure 42. Oscillator subassembly, 1-mc, front view.

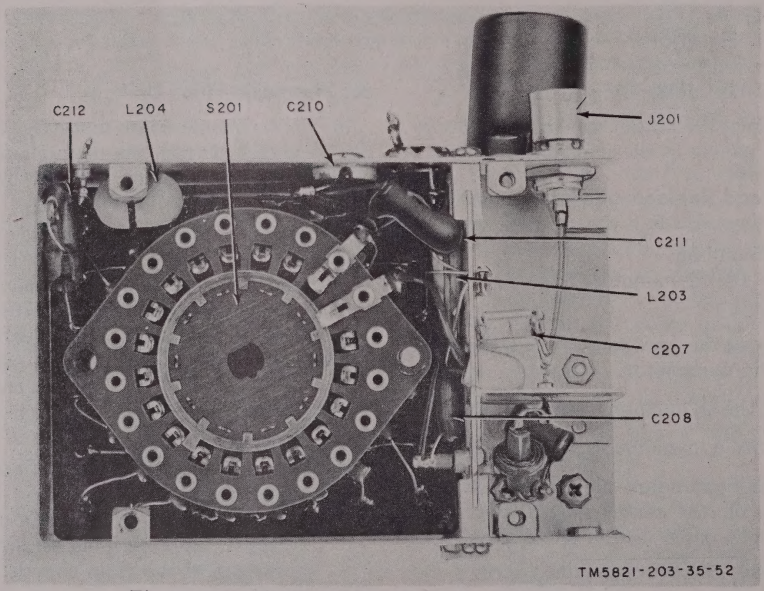


Figure 43. Oscillator subassembly, 1-mc, right side view.

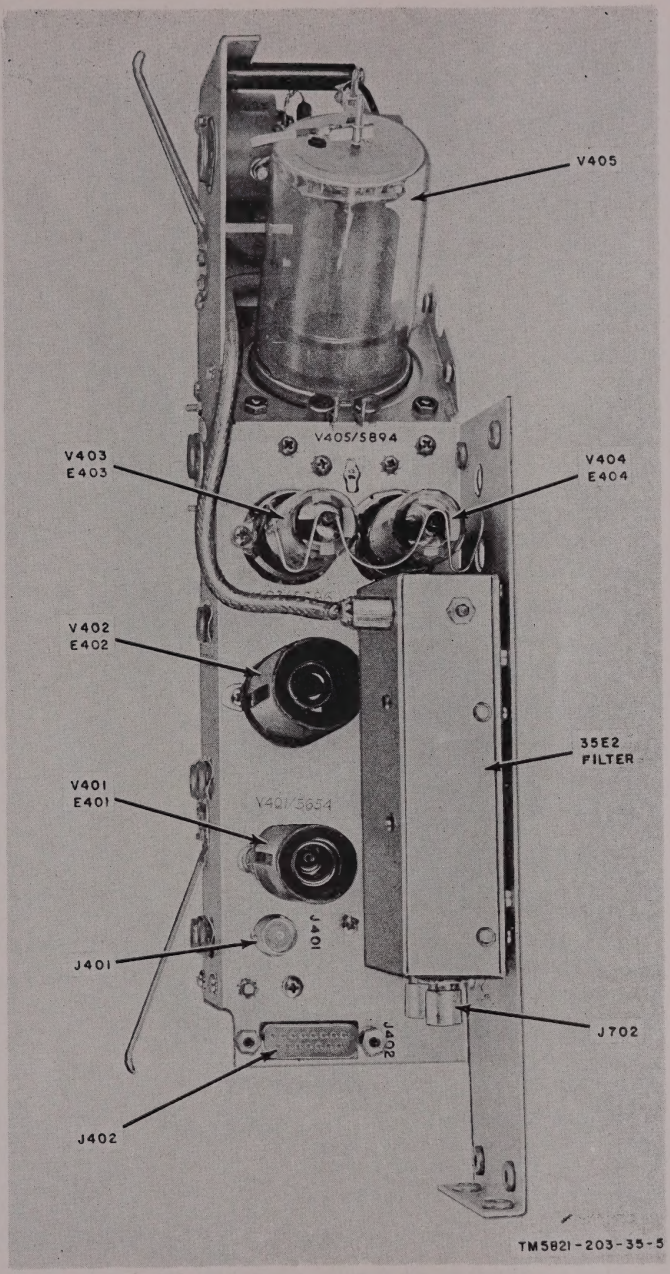


Figure 44. Rf amplifier subassembly, left side view.

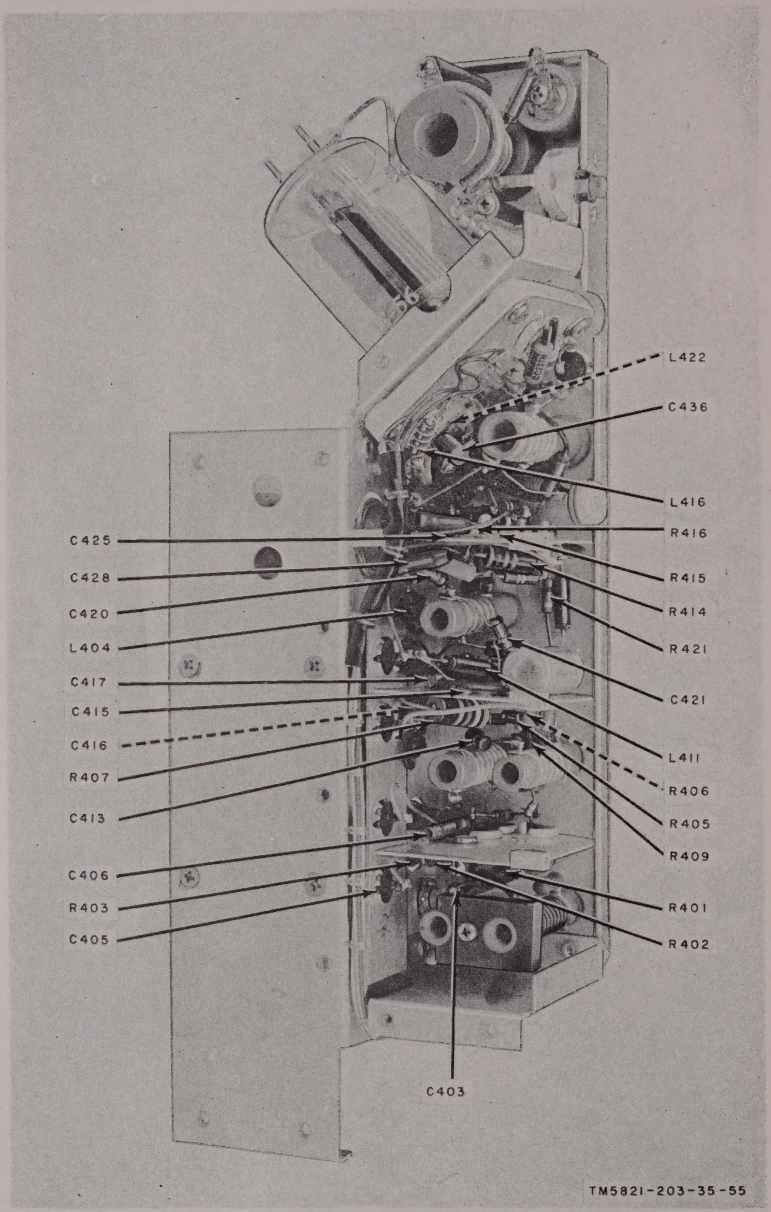


Figure 45. Rf amplifier subassembly, top view.

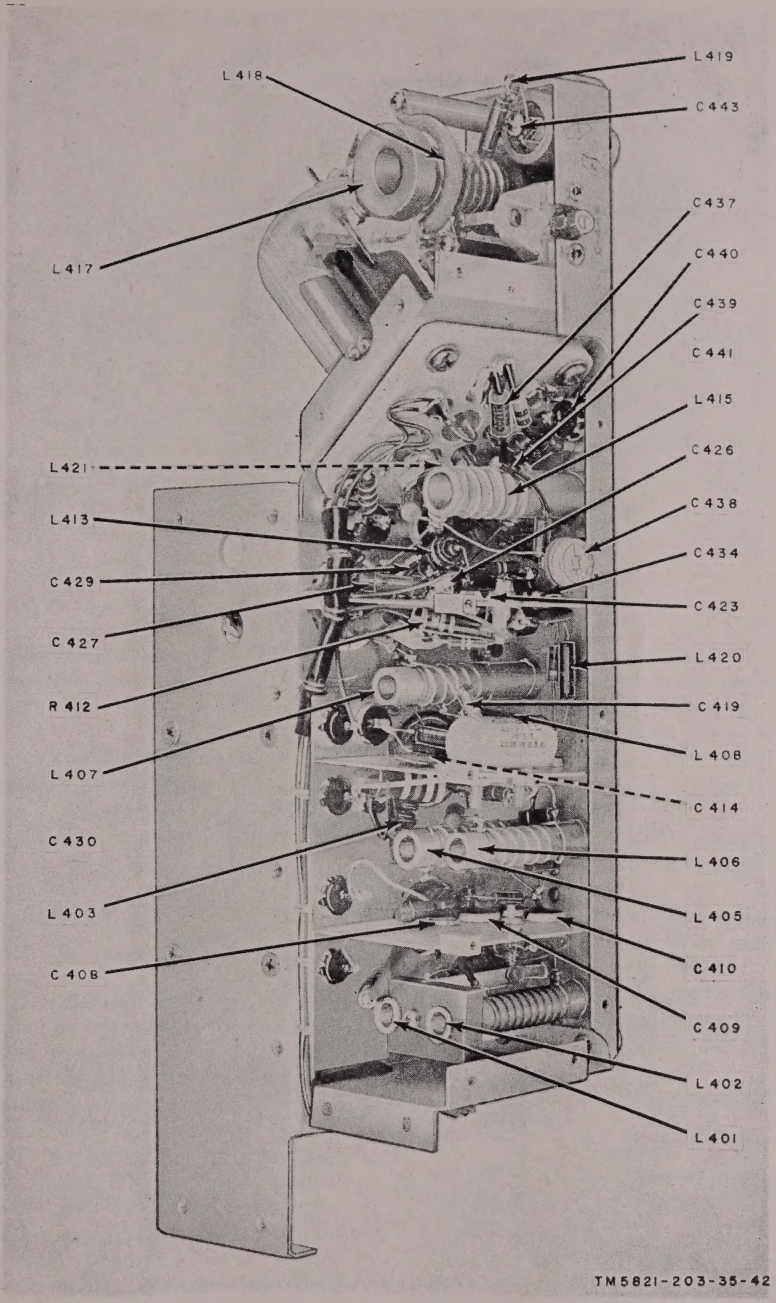


Figure 46. Rf amplifier subassembly, top oblique view.

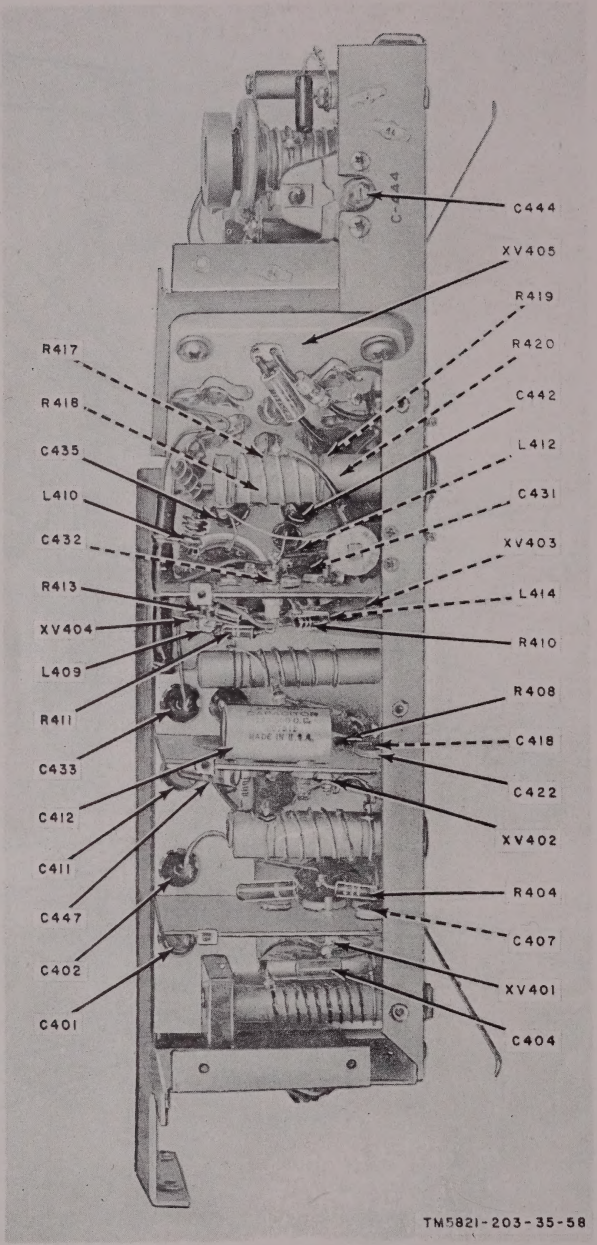


Figure 47. Rf amplifier subassembly, right side view.

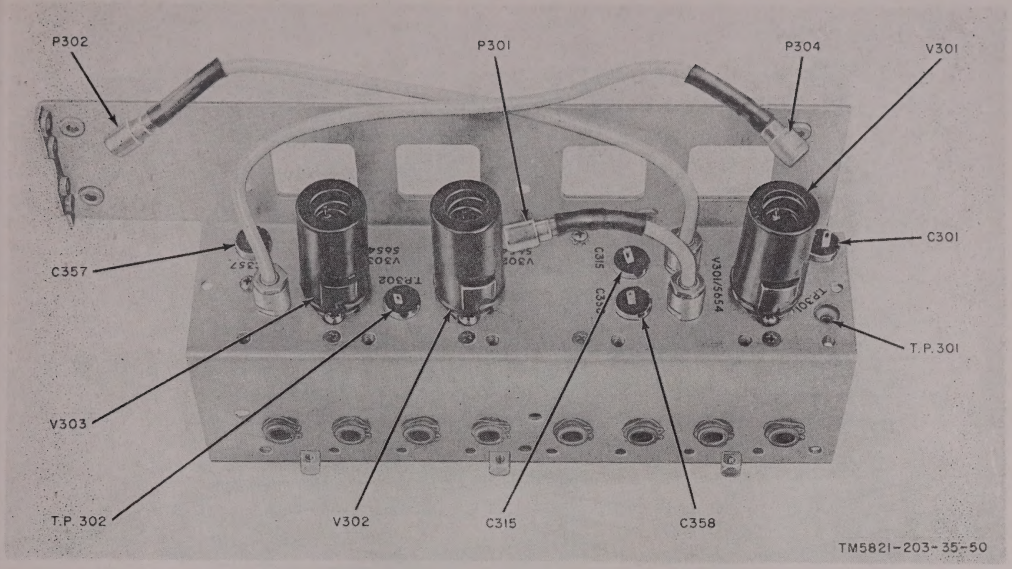


Figure 48. Frequency generator subassembly, left side view.

(2) Replace the plug P601 in jack J702 and plug P602 in jack J701 (fig. 51).
(3) Replace the top cover and left side panel.

67. Removal and Replacement of Autopositioner Motor B601

(fig. 2)

a. Before Autopositioner motor B601 can be removed, remove the front panel from the transmitter. After removing the front panel (par. 59*a*), proceed as follows:

(1) Remove the cap on the front of the motor.
(2) Tag and unsolder the two wires from the front of the motor.
(3) Loosen the screw that holds the wire clamp to the motor and carefully pull out the two wires.
(4) On the rear of the front panel, directly behind the motor, unscrew the three screws that retain the plate behind relay K601 (fig. 37) to the front panel.
(5) Carefully push relay K601 assembly away from the front panel so that the four screws that hold the motor to the front panel are accessible.
(6) Remove the four screws that hold the motor spacer to the front panel and remove the motor and spacer.

b. Replace the motor as follows:

(1) Mount the motor and motor spacer on the front panel and install the four mounting screws on the back of the front panel.
(2) Replace relay K601 assembly (fig. 37) behind the motor and install the three holding screws.
(3) Draw the two motor wires up through the holddown clamp on the motor and tighten the clamp screw.
(4) Solder the two tagged motor wires to the correct terminals on the motor.
(5) Replace the cap on the front of the motor.
(6) Replace the front panel subassembly (par. 59*b*).

68. Removal and Replacement of Slug Rack Mechanism

(fig. 35)

a. Remove the slug rack mechanism by removing both the 0.05-mc oscillator and rf amplifier subassemblies (par. 60*a* and 62*a*). Then

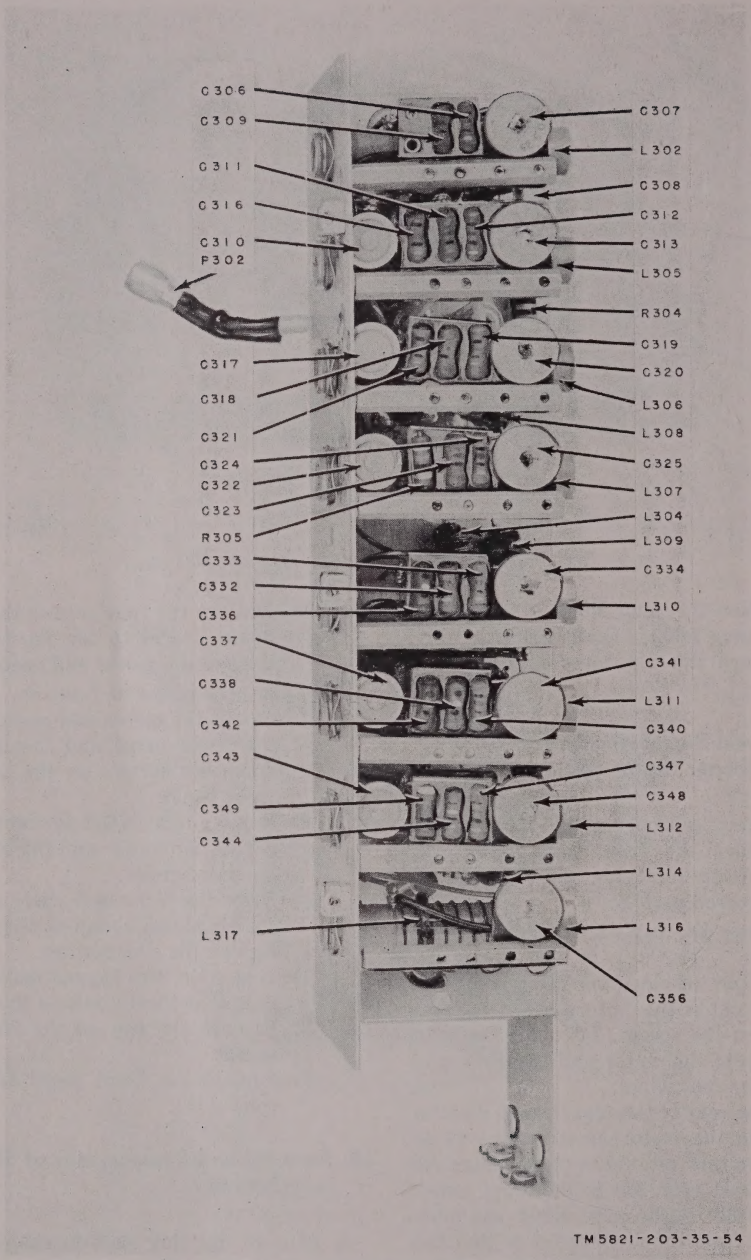


Figure 49. Frequency generator subassembly, right side view.

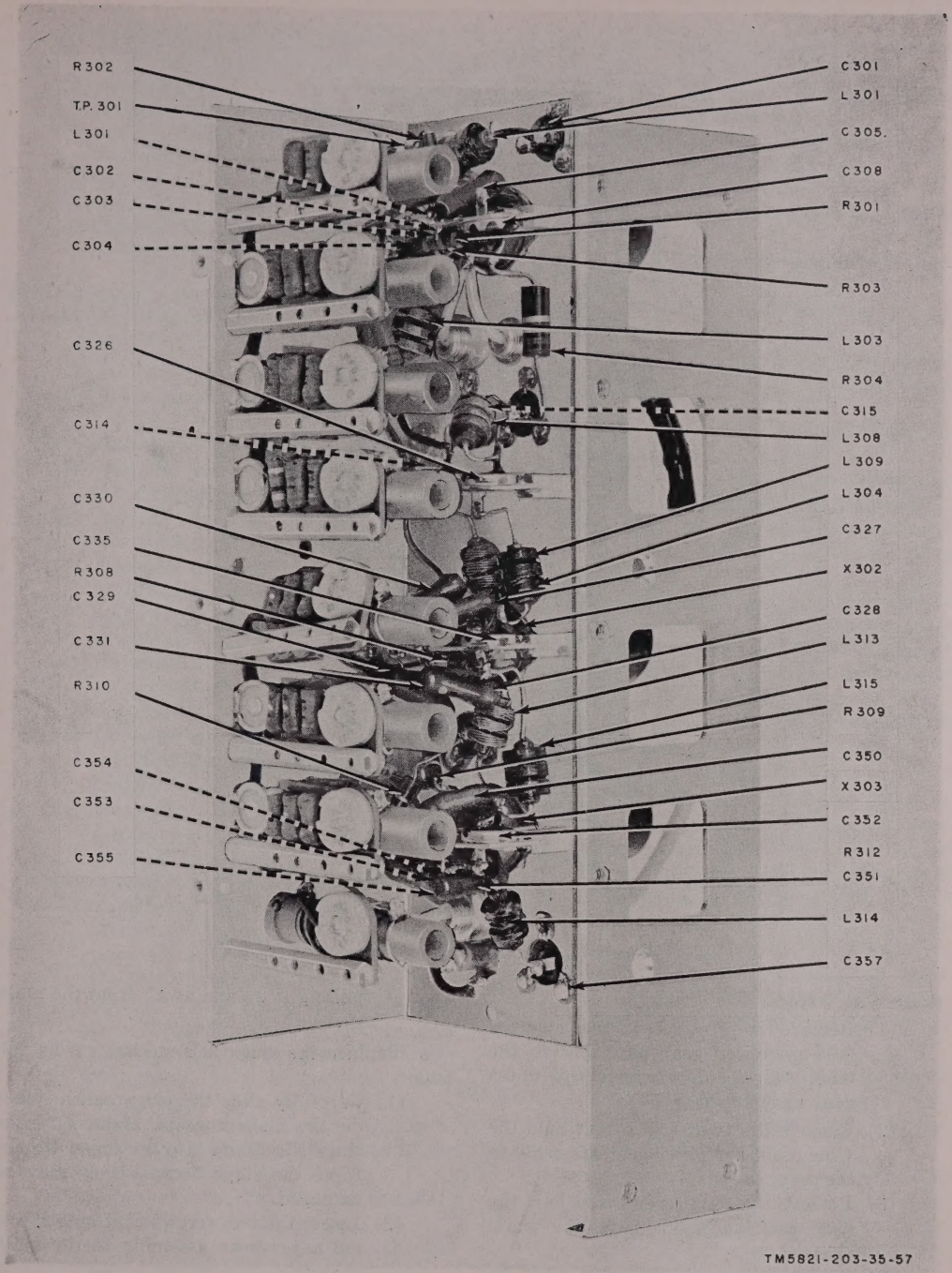


Figure 50. Frequency generator subassembly, oblique top view.

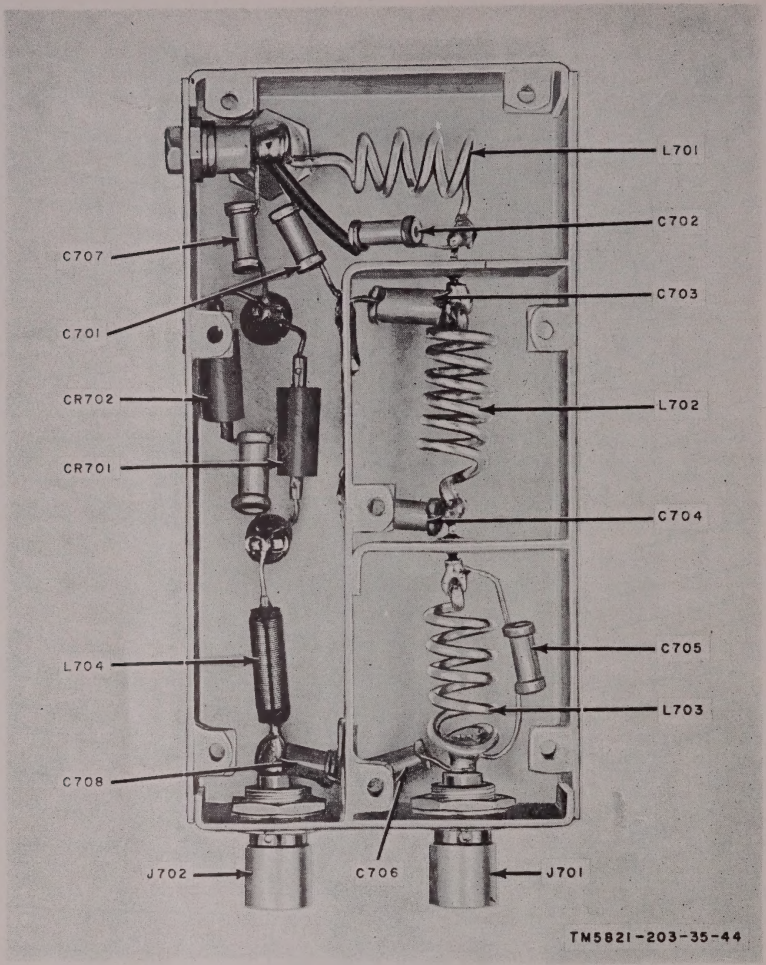


Figure 51. Harmonic filter unit, inside view.

proceed as follows:

(1) Remove the three screws that hold the 0.05-mc miter gear assembly to the main chassis and remove the miter gear assembly (fig. 54).

(2) Remove the two screws that hold the 1-mc oscillator miter gear assembly to the main chassis.

(3) Remove the four screws that hold the slug rack mechanism to the main chassis.

(4) Carefully remove the slug rack by pulling it up and away from the main chassis.

b. Replace the slug rack mechanism as follows:

(1) Carefully slide the slug rack in place on the main chassis. Make sure the slugs slip easily into the cores. Do not force the slugs because they may be damaged.

(2) Insert the two screws that hold the 1-mc miter gear assembly to the main chassis.

(3) Insert the four screws that hold the slug rack mechanism to the main chassis.
(4) Replace the 0.05-mc miter gear assembly (fig. 54) with its three retaining screws.
(5) Replace the rf amplifier subassembly (par. 62*b*).
(6) Replace the 0.05-mc oscillator subassembly (par. 60*b*).

69. Disassembly and Reassembly of Autopositioner System (fig. 52)

a. Disassembly of 0.05-Mc Autopositioner.
(1) Check that the transmitter is tuned to 118.0 mc.
(2) Remove the front panel (par. 59*a*).
(3) Unscrew the two roundhead screws from switch S602 (fig. 37).
(4) Remove the two wafers and both wafer spacers from switch S602 shaft.
(5) Loosen the screw on the clamp that holds the spur gear on the switch shaft and remove the clamp and gear from the shaft.
(6) Unscrew the two roundhead screws from relay K602 (fig. 2) and remove the relay.
(7) Unscrew the three roundhead screws that hold the Autopositioner plate assembly (A–5), fig. 52) and spacing posts (H–1, H–2, H–3) on the front of the front panel and remove the Autopositioner assembly (0–7).

b. Reassembly of 0.05-Mc Autopositioner.
(1) Replace the Autopositioner plate assembly (A–5), fig. 52) to the spacing posts (H–1, H–2, H–3) on the front of the front panel.
(2) Replace relay K602 (fig. 2). Make sure the pawl finger is between the relay spring and the frame. Refer to paragraph 78 for correct adjustment of the relay.
(3) Replace the spur gear and clamp to switch S602 shaft. Tighten the screw on the shaft.
(4) Replace the S602A wafer on the shaft (fig. 37).
(5) Mount the wafer spacers on the S602A wafer.
(6) Replace the S602B wafer on the spacers.
(7) Replace the two roundhead screws from switch S602.
(8) Replace the front panel (par. 59*b*).
(9) Replace the front panel cover.

c. Disassembly of 1-Mc Autopositioner.
(1) Check that the transmitter is tuned to 118.0 mc.
(2) Remove the front panel assembly (par. 59*a*).
(3) Remove the two roundhead screws from switch S601 (fig. 37).
(4) Use a No. 8 Bristo wrench and loosen the screw that holds the hub coupler to the switch shaft.
(5) Remove the hub coupler from the switch shaft.
(6) Remove the two wafers from the switch shaft and both wafer spacers.
(7) Unscrew the two roundhead screws from relay K603 (fig. 2) and remove the relay.
(8) Unscrew the three roundhead screws that retain the Autopositioner plate assembly (A–6, fig. 52) and spacing posts (H-8, H-9, H-10) on the front of the front panel assembly.
(9) Remove the 1-Mc Autopositioner assembly (0-12).

d. Reassembly of 1-Mc Autopositioner.
(1) Replace the Autopositioner plate assembly (A–6, fig. 52) and its three spacing posts (H-8, H-9, H10) to the front of the front panel. Retain them with the three holding screws.
(2) Replace relay K603 (fig. 2) and its two retaining screws. Make sure the pawl finger is between the relay spring and the frame. Refer to paragraph 78 for correct adjustment of the relay.
(3) Replace the two wafers to the shaft of switch S601 (fig. 37) and both wafer spacers. Retain them with the two holding screws.
(4) Replace the hub coupler to the switch shaft. Be sure that the ridge on the coupler is parallel with the bottom (or top) of the front panel assembly. (If the coupler is not lined up correctly,

it will not engage the captive coupler guide on the slug rack mechanism camshaft when the front panel assembly is replaced.)

(5) Use a No. 8 Bristo wrench and tighten the hub coupler retaining screw.

(6) Replace the front panel assembly (par. 59*b*).

Symbol	Name	Collins part No.
A–1	Panel assembly front	561 3638 003
A–2	Handle	503 5086 002
A–3	Bracket	503 4970 001
A–4	Bracket	503 4970 001
A–5	Plate assembly Autopositioner	503 7090 002
A–6	Plate assembly Autopositioner	503 7090 002
A–7	Plate assembly gear	504 9375 002
H–1	Post, spacing	503 4921 001
H–2	Post, spacing	503 4921 001
H–3	Post, spacing	503 4921 001
H–4	Post, spacing	503 4922 001
H–5	Post, spacing	503 4922 001
H–6	Post, spacing	503 4922 001
H–7	Post, spacing	503 4922 001
H–8	Post, spacing	503 4921 001
H–9	Post, spacing	503 4921 001
H–10	Post, spacing	503 4921 001
H–11	Stop, handle	503 4943 001
H–12	Stop, handle	503 4943 001
H–13	Spacer, motor	561 0066 001
H–14	Spacer, clutch	502 1164 002
H–15	Nut - 5/16 x 24 NF–2 steel	334 0249 00
H–16	Ring, retaining	340 0025 00
H–17	Ring, retaining	340 0025 00
H–18	Ring, retaining	340 0087 00
H–19	Ring, retaining	340 0087 00
N–1	Flange 0.05 mc marker L4	561 3670 002
N–2	Flange, 1 mc marker	304 4072 002
O–1	Bearing, sleeve	309 0116 00
O–2	Bearing, sleeve	309 0116 00
O–3	Bearing, sleeve	309 0115 00
O–4	Bearing, sleeve	309 0115 00
O–5	Bearing, sleeve	309 0115 00
O–6	Bearing, sleeve	309 0115 00
O–7	Autopositioner assembly, 0.05-mc	561 3642 004
O–8	Shaft assembly, 0.05 mc	561 3641 002
O–9	Pawl	503 5079 002
O–10	Bearing, sleeve	309 0117 00
O–11	Stud, pawl pivot	503 4918 001
O–12	Autopositioner assembly, 1-mc	561 3639 004
O–13	Shaft assembly, 1-mc	561 3641 002
O–14	Pawl	503 5079 002
O–15	Bearing, sleeve	309 0017 00
O–16	Stud, pawl pivot	503 4918 001
O–17	Bearing, sleeve	309 0115 00
O–18	Bearing, sleeve	309 0115 00
O–19	Bearing, sleeve	504 9371 001
O–20	Gear assembly idler	503 7085 001
O–21	Gear assembly drive	503 7087 001
O–22	Gear assembly drive	504 9372 00
O–23	Drum, clutch	502 1132 002
O–24	Flange, clutch	503 4920 001
O–25	Clutch assembly	502 1825 002
O–26	Spring, clutch	502 7029 002
O–27	Spring, clutch	502 7029 002
O–28	Gear assembly	561 0041 002

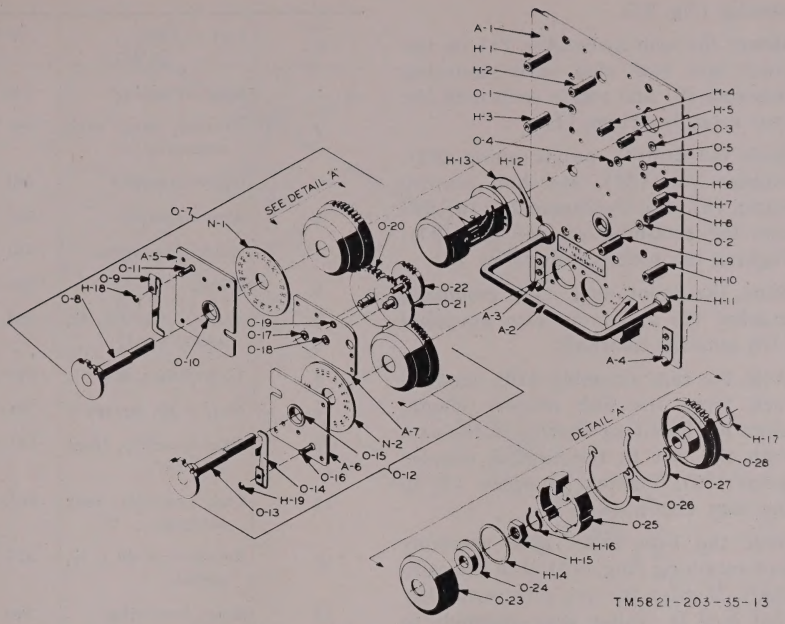


Figure 52. Autopositioner system, exploded view.

70. Disassembly and Reassembly of Slug Rack Mechanism (fig. 53)

a. Disassembly. The slug rack mechanism must be partly disassembled ((2) through (8) below) to remove the 1-mc miter gear assembly. Completely disassemble the slug rack mechanism as follows:

(1) Remove the slug rack mechanism from the main chassis (par. 68*a*).

(2) Remove the three screws that hold the top plate assembly (21) to the two guide assemblies (3 and 5) and standoff (19). Remove the top plate.

(3) Remove the four screws that hold the bottom plate (20) to the two guide assemblies and remove the bottom plate.

(4) Remove the screw that holds the standoff (19) to the bottom plate and remove the bottom plate.

(5) Slide the rear slug rack mounting bracket (2) off the camshaft (16).

(6) Loosen the screw (7) in the clamp (6) that retains the rear cam assembly (11) and remove both from the camshaft.

(7 Loosen the two setscrews (12) that hold the 1-mc miter gear assembly to the camshaft.

(8) Remove the 1-mc miter gear assembly retaining ring (13) and slide the 1-mc miter gear assembly from the camshaft.

(9) Loosen the screw (7) in the clamp (6) that retains the front cam assembly (10). Slide the cam assembly off the camshaft.

(10) Slide the remaining slug rack mounting bracket (2) from the camshaft.

(11) Loosen the screw (7) on the clamp (6) that retains the coupler hub (24) to the camshaft. Remove the retaining coupler pin (25) and slide the cam, clamp, coupler hub, and captive coupler guide (26) off the camshaft.

(12) Remove the four retaining rings (1) from each of the arm assemblies (4) and remove the assemblies from the front and rear slug rack mounting brackets.

b. Reassembly (fig. 53).

(1) Mount the arm assemblies (4) on the front and rear slug rack mounting brackets (2) and retain each with the four retaining rings (1).

(2) Slide the captive coupler guide (26), coupler hub (24), and hub coupler clamp (6) onto the camshaft (16). Insert the retaining coupler pin (25). Tighten the socket head screw (7).

(3) Slide the front slug rack mounting bracket (2) and front cam assembly (10) onto the camshaft.

(4) With the cam assembly (10) one-half inch from the hub coupler clamp, align the hole (not shown) in the cam with the slot in the captive coupler guide (26). Tighten the screw (7) in the cam clamp (6).

(5) Slide the 1-mc miter gear assembly and retaining ring (13) onto the camshaft. Tighten the two sctscrews (12) that hold the miter gear assembly to the camshaft.

(6) Slide the rear cam assembly (11) onto the camshaft and position the cam three-eights of an inch from the end of the shaft.

(7) Align the hole (not shown) in the rear cam with the hole in the front cam and tighten the clamp screw.

(8) Slide the rear slug rack mounting bracket (2) onto the camshaft.

(9) Attach the standoff (19) with one retaining screw to the bottom plate assembly (20).

(10) Attach the bottom plate assembly with the four holding screws to the two guide assemblies (3 and 5).

(11) Attach the top plate assembly (21) with the three holding screws to the two guide assemblies and standoff (19).

Item No.	Name	Collins part No.
1	Ring, retaining	340 0250 00
2	Bracket, slug rack mounting	561 3565 002
3	Guide assembly	561 3677 002
4	Arm assembly	561 3679 002
5	Guide assembly	561 3578 002
6	Clamp	504 7537 002
7	Screw, 4-40 x ½, socket head	324 0300 00
8	Lockwasher, #4	310 3240 00
9	Nut, 4–40, square	334 0485 00
10	Cam assembly, front soldered	561 3686 002
11	Cam assembly, rear soldered	561 3685 002
12	Setscrew, 6–40 x ⅛, socket	335 0008 00
13	Ring, retaining	340 0253 00
14	Gear, fab	561 0394 001
15	Bracket, machined	561 3569 002
16	Camshaft	561 3591 002
17	Shaft, miter gear	561 3592 002
18	Washer, thrust	561 3680 001
19	Standoff	561 3687 001
20	Plate assembly, bottom	561 3607 003
21	Plate assembly, top	561 3606 003
22	Screw, slug adjustment	561 3579 002
23	Setscrew	561 3706 002
24	Hub, coupler	561 3631 002
25	Pin, coupler, retaining	561 3629 002
26	Guide, coupler, captive	561 3628 002

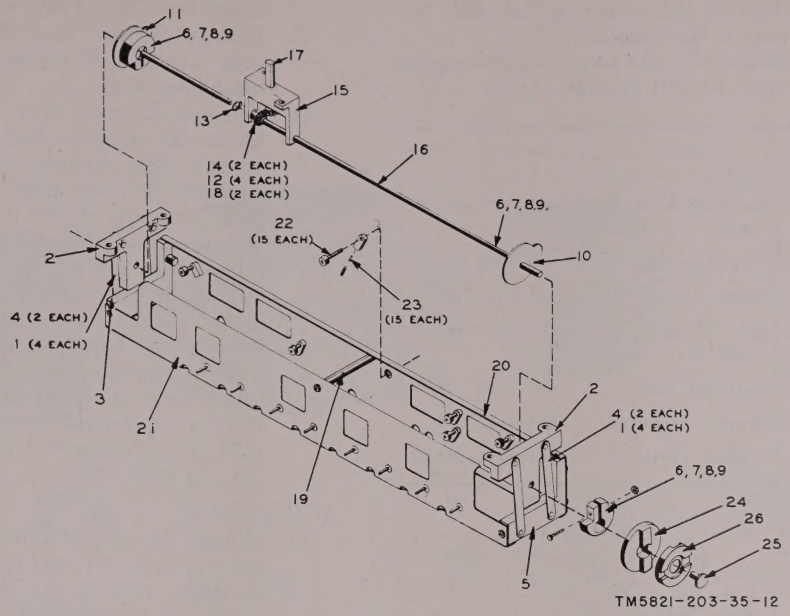


Figure 53. Slug rack mechanism, exploded view.

71. Disassembly and Reassembly of Miter Gear Assemblies

a. Disassembly of 0.05-Mc Miter Gear Assembly (fig. 54).

(1) Remove the 0.05-mc oscillator subassembly (par. 60*a*).

(2) Remove the three screws that hold the miter gear assembly to the main chassis and remove the 0.05-mc miter gear assembly from the chassis.

(3) Remove the two socket head setscrews (1) from the miter fab gear (5) on the 0.05-mc shaft (3).

(4) Remove the retaining ring (2) from the 0.05-mc shaft.

(5) Extract the 0.05-mc shaft from the machined bracket (6).

b. Reassembly of 0.05-mc Miter Gear Assembly (fig. 54).

(1) Insert the 0.05-mc shaft (3) in the machined bracket (6), through one of the miter fab gears (5), and tighten the setscrews (1).

(2) Replace the retaining ring (2) to the 0.05-mc shaft.

(3) Replace the 0.05-mc miter gear assembly to the main chassis and retain it with the three holding screws.

(4) Replace the 0.05-mc oscillator subassembly (par. 60*b*).

c. Disassembly of 1-Mc Miter Gear Assembly.

(1) Remove the slug rack (par. 68*a*).

(2) Perform the procedures in paragraph 70*a* (2) through (8).

(3) Loosen the two setscrews (12, fig. 53) that hold the fab gear (14) to the miter gear shaft (17).

(4) Slide the miter gear shaft from the machined bracket (15).

d. Reassembly of 1-Mc Miter Gear Assembly (fig. 53).

(1) Insert the miter gear shaft (17) in the machined bracket (15).

(2) Place one of the fab gears (14) on the miter gear shaft (17) and tighten the two socket setscrews (12).

(3) With the thrust washer (18) between the other gear and machined bracket, slide the machined bracket and gear onto the camshaft (16).

(4) Tighten the setscrews that hold the gear to the camshaft.
(5) Reassemble the slug rack mechanism (par. 70*b* (6) through (11)).

Item No.	Name	Collins part No.
1	Setscrew, 4–48, socket	335 0037 00
2	Ring, retaining	340 0250 00
3	Shaft, 0.05-mc	561 3575 002
4	Shaft assembly, 0.05-mc	561 3596 002
5	Gear, fab, miter	561 3598 002
6	Bracket, machined	561 3571 002
7	Washer, thrust	561 3774 002

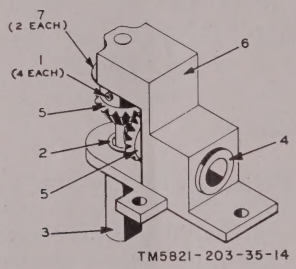
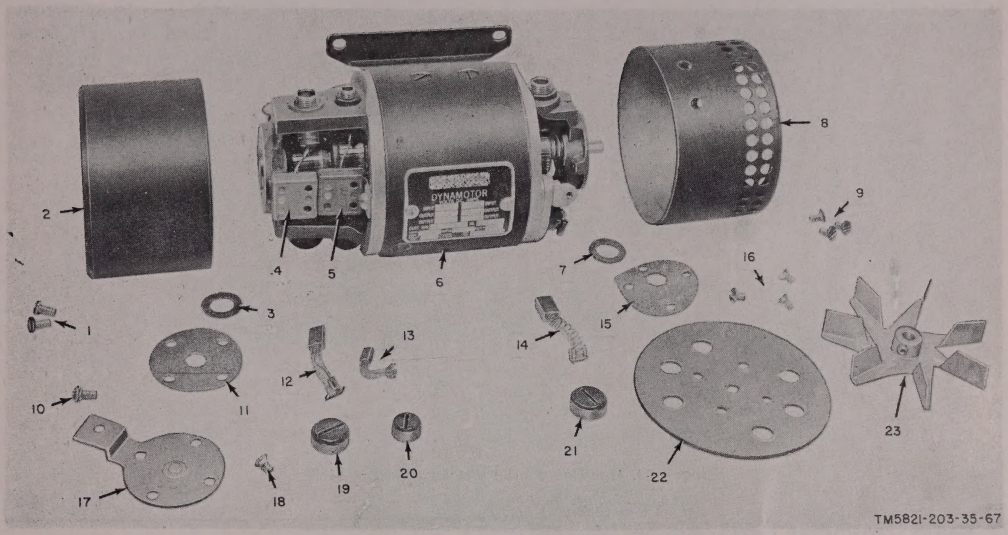


Figure 54. Miter gear assembly, 0.05 mc.

72. Disassembly and Reassembly of Dynamotor D501 (fig. 55)

a. Disassembly.
(1) Remove the dynamotor from the main chassis (par. 65*a*).
(2) Remove the three impeller endbell retaining screws (9) that retain the impeller endbell (8).
(3) Slide the impeller endbell from the dynamotor frame (6).
(4) Remove the two endbell retaining screws (1) that retain the other endbell (2) and slide the endbell from the dynamotor frame.
(5) Remove the two 250-volt brush holder caps (19) and remove the 250-volt brush assemblies (12).
(6) Remove the two 350-volt brush holder caps (20) and remove the 350-volt brush assemblies (13).
(7) Remove the two input brush holder caps (21) and remove the input brush assemblies (14).
(8) Use a 3/32 -inch Allen wrench and loosen the setscrew that retains the impeller (23). Remove the impeller.
(9) Remove the four input end gasket plate retaining screws (16) that retain the input end gasket plate (22) behind the impeller. Remove the input end gasket plate (22), input end gasket (15), and input end shim (7).
(10) Remove the four output end gasket plate retaining screws (10) that retain the output end gasket plate (17). Remove the output end gasket plate (17), output end gasket (11), and output end shim (3).

b. Reassembly.
(1) Replace the input end gasket (15), input end shim (7), and input end gasket plate (22) to the impeller (23) end of the dynamotor and retain them with the four input end gasket plate retaining screws (16).
(2) Replace the output end gasket (11), output end shim (3), and output end gasket plate (17) to the output end of the dynamotor and retain them with the four output end gasket plate retaining screws (10).
(3) Replace the impeller (23) and tighten its setscrew; use a 3/32-inch Allen wrench.
(4) Replace the two 250-volt brush assemblies (12) and 250-volt brush holder caps (19).
(5) Replace the two 350-volt brush assemblies (13) and 350-volt brush holder caps (20).
(6) Replace the two input brush assemblies (14) and input brush holder caps (21).
(7) Slide the impeller endbell (8) in place and retain it with the three impeller endbell retaining screws (9).
(8) Replace the endbell (2) on the opposite end of the dynamotor and retain it with the two endbell retaining screws (1).



1 Endbell retaining screws
2 Endbell
3 Output end shim
4 250-volt output capacitor
5 350-volt output capacitor
6 Dynamotor frame
7 Input end shim
8 Impeller endbell
9 Impeller endbell retaining screws
10 Output end gasket plate retaining screws
11 Output end gasket
12 250-volt brush assembly
13 350-volt brush assembly
14 Input brush assembly
15 Input end gasket
16 Input end gasket plate retaining screws
17 Output end gasket plate
18 Output end gasket plate retaining screw
19 250-volt brush holder cap
20 350-volt brush holder cap
21 Input brush holder cap
22 Input end gasket plate
23 Impeller

Figure 55. Dynamotor D501.

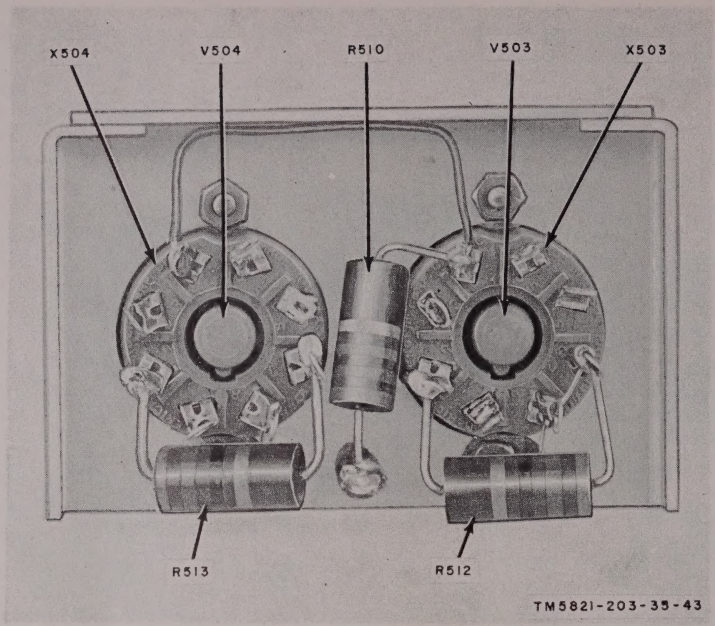


Figure 56. Modulator tube bracket, bottom view.

73. Radio Transmitter T–595/AR, Sections not to be Removed

Removal of the modulator tube bracket, the relay door, the back panel, and the audio circuit assembly is impractical because of their design. Therefore, remove only the component parts of these sections when necessary. The sections are shown in figures 56 through 60.

74. Lubrication of Autopositioner System (fig. 52 and 53)

a. General. Lubrication of the Autopositioner system is necessary at 6-month intervals. All parts of the Autopositioner, except the shaft bearings, can be lubricated easily without disassembly. However, lubrication of the shaft bearings requires extensive disassembly of the Autopositioner (par. 69). The following chart lists the parts of the Autopositioner and the slug rack to be lubricated and the lubricants for each:

	Lubrication point	Lubricant
AUTOPOSITIONER	Pawl pivot	Lubricating oil, general purpose (OGP), Mil–L–7870
	Shaft bearings	
	Gear train	Grease, aircraft and instrument (GL), Mil–G–3278
SLUG RACK	Slug rack bearings	Lubricating oil general purpose (OGP), Mil–L–7870
	Shaft bearings	
	Cam follower rollers	
	Miter gears	Grease, aircraft and instrument (GL), Mil–G–3278

b. Lubricating Techniques. When lubricating the pawl pivots, shaft bearings, slug rack bearings, and cam follower rollers, use only 1 drop of oil (OGP) on each. Excess oil (OGP) applied to the 0.05-mc pivot will run down over the contacts of relay K602 and cause improper operation of the relay. Excess oil applied to the shaft bearings will run down both sides of the front panel and cause the sides to become dirty and oily. When lubricating the gear train and miter gears, apply only a very small quantity of grease (GL) with a brush. If an excessive amount of grease (GL) is applied, dirt will accumulate on the gears and switches and thus prevent correct rotation and operation. Excess grease may be thrown off during rotation and cause components on the back of the front panel to become dirty and greasy.

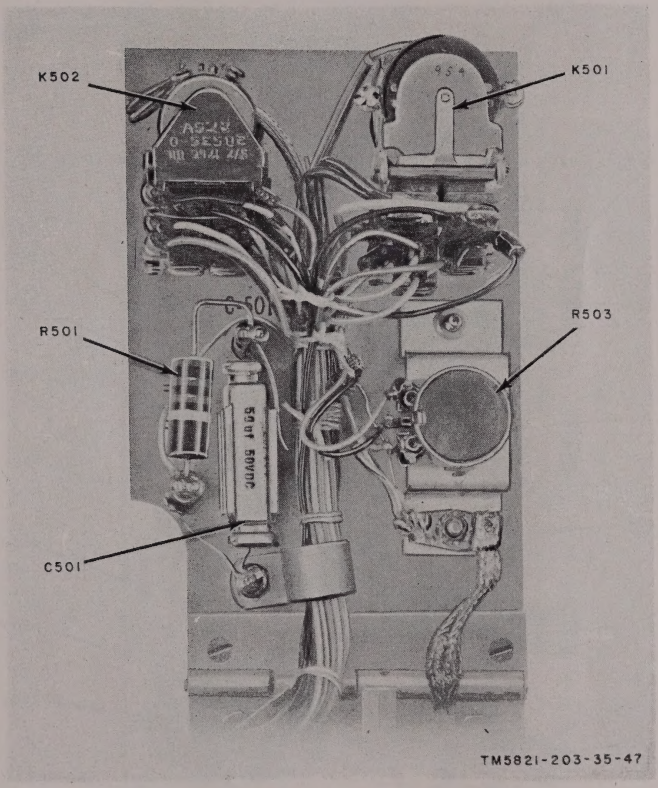


Figure 57. Relay door, inside view.

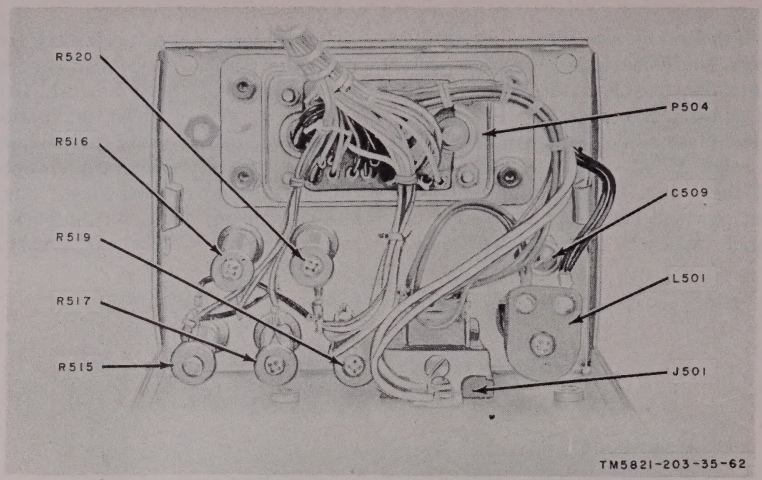


Figure 58. Back panel, inside view.

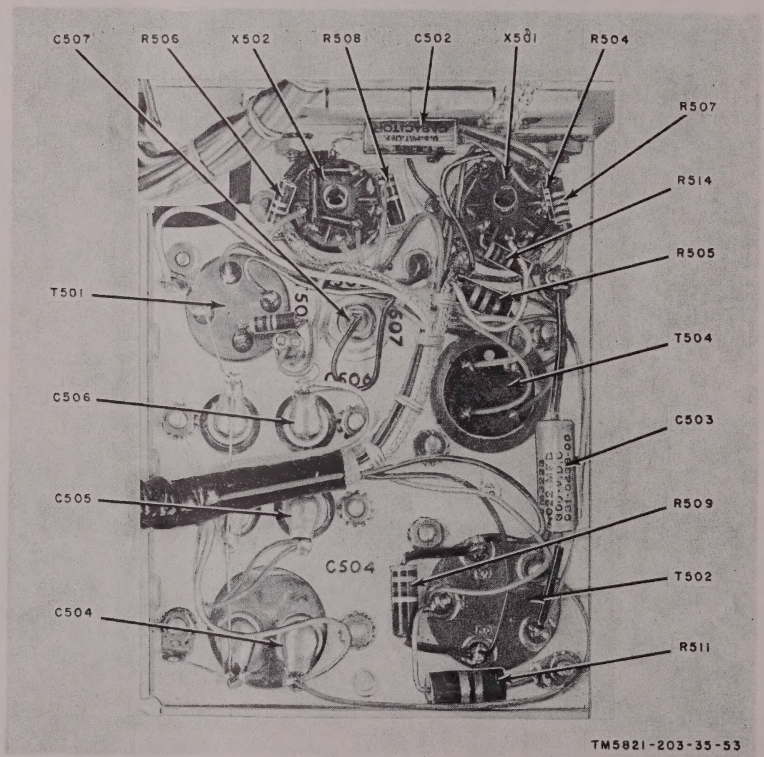


Figure 59. Audio components, right side view.

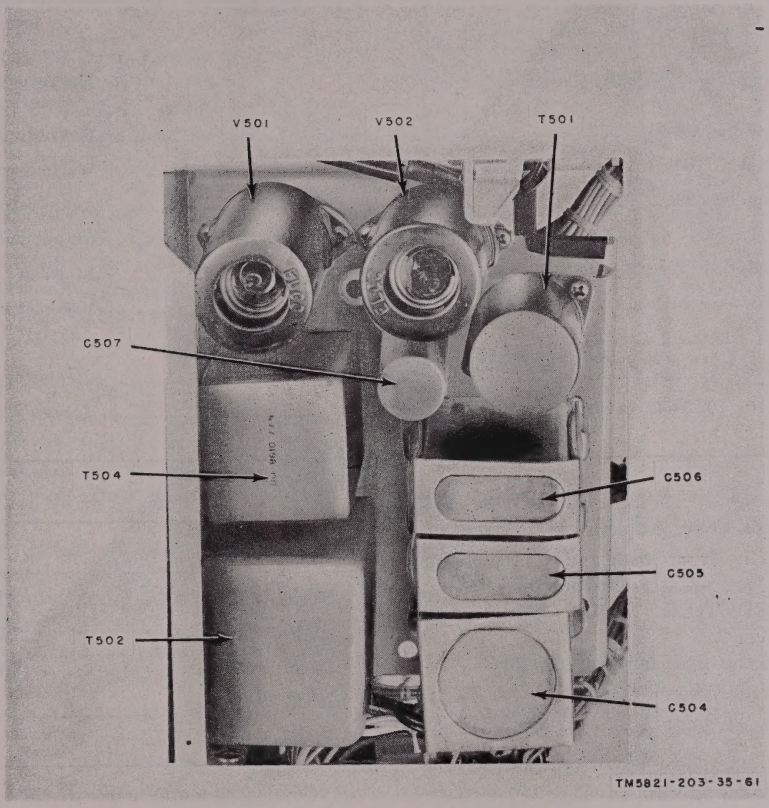


Figure 60. Audio components, left side view.

75. Test Equipment Required for Adjustments

The only equipment required for adjusting the crystal switch assemblies, the Auto-positioner relays, and wafer switches is the crank assembly (Collins part No. 505–2059–001). The following chart lists the test equipment required for adjusting the modulation and sidetone levels of Radio Transmitter T–595/AR.

Item	Technical manual	Common name
Electronic Equipment Maintenance Kit MK–430/ART (par. 42 - 50).		Maintenance kit
Power Supply PP–1104A/G	TM 11–5126	Power supply
RF Wattmeter AN/URM–43A	TM 11–5133	Wattmeter
Audio Oscillator TS–382D/U	TM 11–2684A	Audio oscillator
Output Meter TS–585C/U	TM 11–5017	Output meter
Cord CG–92B/U (p/o TS–118A/AP).	TM 11–1036A	Rf cable
Electronic Multimeter ME–30A/U	TM 11–5132	Multimeter
Cord Assembly, Electrical CD–1252.	None	
Oscilloscope OS–8C/U	TM 11–1214A	Oscilloscope
Hookup wire, No. 20 AWG (approximately 6 feet long).	None	Hookup wire

76. Modulation Level Adjustment

a. Remove the front cover and the right-hand side panel cover on the transmitter.

b. Turn SIDETONE LEVEL control fully clockwise (fig. 2).

c. Connect the maintenance kit to P504 on the transmitter (fig. 63).

d. Set the controls on the maintenance kit (par. 77*c*).

e. Connect the power supply to the maintenance kit; set the circuit breaker level to ON and adjust the output to 27.5 volts.

f. Connect the wattmeter to ANT jack on the transmitter and set the wattmeter switch to 60W.

g. Set the controls on the oscilloscope as follows:

Control	Position
SYNC SELECTOR	EXT
HOR ATTEN	DC
VERT ATTEN	DC
HOR GAIN	1
VERT GAIN	1

Caution: **To prevent burning the screen of the cathode-ray tube, adjust the INT control so that the trace is no brighter than is necessary.**

h. Connect hookup wire to the vertical deflection plates (notes, fig. 63).

i. Turn on the oscilloscope and position dot on 0 on the horizontal axis, and to left edge of the screen.

j. Position the hookup wire in the center of coil L417 through the hole on the top of the transmitter.

k. Set the XMT-STBY switch on the maintenance kit to XMT.

l. Move the hookup wire in coil L417 up or down, until the vertical trace on the oscilloscope (deflected to right) equals A, figure 63.

m. Set the XMT-STBY switch to STBY.

n. Connect the DC input on the oscilloscope to the SIDETONE jack on the maintenance kit.

o. Connect the audio oscillator to the multimeter; connect the multimeter to the MIKE jack on the maintenance kit.

p. Turn on the multimeter and set the range selector switch to 1.

q. Turn on the audio oscillator and set the output to 0.25 volt at 1,000 cycles.

r. Set the XMT-STBY switch to XMT.

s. Adjust modulation level control potentiometer R503 (on the right-hand side rear of the transmitter) until the oscilloscope pattern is equal to B, figure 63.

t. Adjust SIDETONE LEVEL control potentiometer R605 (par. 77).

u. Turn off and disconnect all equipment.

v. Replace the front cover and side panel on the transmitter.

77. Sidetone Adjustment

***Caution:* Do not allow the XMT-STBY switch on the maintenance kit (fig. 22) to remain in the XMT position longer than 1 minute. Prolonged keying may cause the dynamotor to overheat.**

a. Remove the front cover from the transmitter.

b. Connect the maintenance kit to P504 on the transmitter (fig. 62).

c. Set the controls on the maintenance kit as follows:

Control	Position
27 VDC ON-OFF	ON
ACFT POWER-EXT POWER	EXT POWER
Frequency selector control	118.0
DCD-SCS	SCS
XMT-STBY	STBY

d. Connect the power supply to the maintenance kit; set the circuit breaker level to ON and adjust the output to 27.5 volts.

e. Connect the wattmeter to ANT jack on the transmitter and set the wattmeter switch to 60W.

f. Connect the output meter to the SIDETONE jack on the maintenance kit.

g. Connect the audio oscillator to the multimeter; connect the multimeter to the MIKE jack on the maintenance kit.

h. Set the impedance control on the output meter to 50 on the X10 bracket and the MULTIPLY BY control to X10.

i. Turn on the multimeter and set the range selector switch to 1.

j. Turn on the audio oscillator and set the output to 0.25 volt at 1,000 cycles.

k. Set the XMT-STBY switch on the maintenance kit to XMT.

l. Adjust SIDETONE LEVEL control R605 (fig. 2) to obtain a reading of 5 (0-50 scale) on the output meter.

m. Turn off and disconnect all equipment.

n. Replace the front cover on the transmitter.

78. Adjustment of 0.05-Mc Autopositioner Relay K602 and 1-Mc Autopositioner Relay K603 (fig. 2)

Incorrect adjustment of relays K602 and K603 may prevent Autopositioner motor B601 from running, prevent the Autopositioner from setting up, or cause the motor to run after the Autopositioner completes tuning. Adjust relay K602 or K603 as follows:

a. Relay K602 Adjustment.

(1) Remove the relay from the Autopositioner plate assembly (par. 69).

(2) Insert the Autopositioner crank assembly into the hole in the gear plate assembly (A-7, fig. 52) just below the motor on the front panel.

(3) Seat the pawl (0-9) in a notch of the stop wheel on the end of the 0.05-mc shaft assembly (0-8). Turn the gear train with the crank assembly to allow the pawl to seat fully.

(4) Replace the relay (par. 69*b*) so that the pawl finger comes between the relay spring and the frame about the middle of the spring.

(5) Line up the mounting hole farthest from the pawl and start the mount-

ing screw without applying any pull to the relay spring. (Let the relay turn counterclockwise slightly.)

(6) Turn the relay clockwise about this screw, which will let the pawl finger slide between the spring and the relay arm. Start the second screw.

(7) Hold the pawl fully seated in the stop-wheel notch and hold the relay against the pawl finger. Tighten the mounting screws. Check to be sure that the pawl is fully seated and that the relay clapper and arm have no appreciable free play. Reposition the relay if necessary to meet these conditions.

(8) Press the relay clapper and turn the Autopositioner manually by using the crank assembly, and check the clearance between the pawl tip and stop wheel. This should be approximately one sixty-fourth inch or less. If adjustment is required, loosen the two screws near the hinge point and slide the hinge plate up or down as required. (Adjustment may be aided by placing a 0.020-inch feeler gage between the clapper and coil core.) When tightening these screws, be careful that the relay arm does not rub on the side of the relay frame or against the stop wheel and that the spring does not shift closer to the contacts.

(9) Check the operation of the motor contacts. With power off, press the relay clapper and turn the gearing to allow the pawl tip to rest on the stop wheel between notches. In this position, motor-operating contacts should be closed, and the clapper and arm should have some free play to permit full contact pressure at the contact points. If necessary, bend the stationary contact in or out. Failure to make contact in this position may allow the Autopositioner to *set up* at the notches. Excessive free play of the clapper in this position indicates insufficient contact opening in the deenergized position.

b. Relay K603 Adjustment. The adjustment for relay K603 is the same as the adjustment for relay K602 (*a* above) with the exception that all reference designations will apply to the 1-mc Autopositioner assembly (0–12, fig. 52) instead of the 0.05-mc Autopositioner assembly (0–7).

79. Adjustment of Autopositioner Wafer Switches S601 and S602
(fig. 37)

If a new front panel is to be placed on the transmitter, it may be necessary to adjust the front panel wafer switches and gears until the couplers between the front panel and the transmitter are aligned. To perform this adjustment, follow the procedure below.

a. Insert the Autopositioner crank assembly into the hole in the gear plate assembly (A–7, fig. 52) just below the motor on the front panel.

b. Hold down the clappers of relays K602 and K603 (pawls 0–9 and 0–14 out of stop wheels) and, at the same time, rotate the crank assembly until the Autopositioner switches are in the correct position.

80. Adjustment of Crystal Switch Assemblies

After a new or repaired 0.05-mc or 1-mc oscillator subassembly is replaced, it may be necessary to adjust the crystal switch assemblies (fig. 38 and 43) so that the Autopositioner frequency indication is synchronized with the proper crystals. For example, a frequency indication of 132.4 requires selecting crystal Y127 at crystal switch S101 and crystal Y215 at crystal switch S201. (The number and frequency of each crystal are shown in the charts (*h* and *i* below). Adjust the switch assemblies as follows:

a. Insert the Autopositioner crank assembly into the hole in the gear plate assembly (A–7, fig. 52) just below the motor on the front panel.

b. While rotating the crank, check to see that the crystal switches rotate freely.

c. Operate the Autopositioner mechanism until the lower rotor blades make contact with the switch clips. The rotor blades and switch clips are visible in the inspection holes beneath the slug rack.

d. Loosen the shaft couplers and rotate the

Autopositioner until the Autopositioner frequency indication is 132.4.

e. Tighten the shaft couplers.

f. Check the operation of the channeling system. Set the frequency control unit to 132.4 and observe the switch rotor blades through the inspection holes.

g. Verification of crystal switch operation and selection may be made with an ohmmeter. Check for continuity from the ungrounded crystal socket contact to pin 1 on the oscillator tube (V101 or V201).

h. Crystal switch S101 crystal frequencies are listed in the following chart:

Crystal No.	Frequency in megacycles	Fractional mc channel
Y119	3.08700	0.00
Y120	3.09255	0.05
Y121	3.09811	0.10
Y122	3.10366	0.15
Y123	3.10922	0.20
Y124	3.11477	0.25
Y125	3.12033	0.30
Y126	3.12589	0.35
Y127	3.13144	0.40
Y128	3.13700	0.45
Y129	3.14255	0.50
Y130	3.14811	0.55
Y131	3.15366	0.60
Y132	3.15922	0.65
Y133	3.16477	0.70
Y134	3.17033	0.75
Y135	3.17589	0.80
Y136	3.18144	0.85
Y137	3.18700	0.90
Y138	3.19255	0.95

i. Crystal switch S201 crystal frequencies are listed in the following chart:

Crystal No.	Frequency in megacycles	Unit mc channel
Y201	10.02411	118
Y202	10.13522	119
Y203	10.24633	120
Y204	10.35744	121
Y205	10.46855	122
Y206	10.57966	123
Y207	10.69077	124
Y208	10.80188	125
Y209	10.91300	126
Y210	11.02411	127
Y211	11.13522	128
Y212	11.24633	129
Y213	11.35744	130
Y214	11.46855	131
Y215	11.57966	132
Y216	11.69077	133
Y217	11.80188	134
Y218	11.91300	135

Section III. ALIGNMENT

81. Test Equipment Required for Alignment

The following test equipment is required for alignment of Radio Transmitter T–595/AR:

Test equipment	Technical manual	Common name
Signal Generator TS-497B/URR	TM 11-5030A	Rf signal generator
Multimeter TS-352B/U	TM 11-5527	Multimeter
Multimeter Meter ME-26/U	TM 11-6625-200-12	Voltmeter
Q Meter TS-617A/U	TM 11-2635	Q-meter
RF Wattmeter AN/URM-43A	TM 11-5133	Wattmeter
Electronic Equipment Maintenance Kit MK-430/ART (par. 42-50)		Maintenance kit
Power Supply PP-1104A/G	TM 11-5126	28 vdc power supply

82. Adjustment of 0.05-Mc and 1-Mc Oscillator Grid Trimmer Capacitors

Note. Apply power to the transmitter (par. 83*b* through *d*).

Both the 0.05-mc and the 1-mc oscillators have grid trimmer capacitors C101 and C201 respectively which must be adjusted so that the total circuit capacitance is 32 micromicrofarads (uuf). These capacitors are factory-adjusted and do not require readjustment unless major changes have been made in the oscillator circuitry. If adjustment is necessary, proceed as follows:

a. Adjustment of 0.05-Mc Oscillator Grid Trimmer Capacitor C101 (fig. 40).

(1) Set the Autopositioner to 118.0 mc.
(2) Turn the transmitter primary power off.
(3) Remove the left side panel from the transmitter.
(4) Remove the crystal box cover from the 0.05-mc oscillator subassembly.
(5) With a pair of needle-nosed pliers, carefully remove 3.08700-mc crystal Y119.
(6) Use Q-meter coil L105 and adjust the Q-meter to measure the capacitance.
(7) Connect a pair of test leads from the Q-meter to the crystal socket; replace the crystal box cover on the oscillator subassembly and measure the capacitance.
(8) With the transmitter alignment tool, adjust capacitor C101 until the total circuit capacitance to ground is 32 uuf.
(9) Replace the crystal and secure the crystal box cover.
(10) Replace the transmitter side panel.

b. Adjustment of 1-Mc Oscillator Grid Trimmer Capacitor C201 (fig. 41).

(1) Set the Autopositioner to 118.0 mc.
(2) Turn the transmitter primary power off.
(3) Remove the left side panel from the transmitter.
(4) Remove the crystal box cover from the 1-mc oscillator subassembly.
(5) With a pair of needle-nosed pliers, carefully remove 10.02411-mc crystal Y201.
(6) Use Q-meter coil L102 and adjust the Q-meter to measure capacitance.
(7) Connect a pair of test leads from the Q-meter to the crystal socket; replace the crystal box cover on the oscillator subassembly and measure the capacitance.
(8) With the transmitter alignment tool, adjust capacitor C201 until the total circuit capacitance to ground is 32 uuf.
(9) Replace the crystal and secure the crystal box cover.
(10) Replace the transmitter side panel.

83. Alignment of Rf Amplifier Subassembly

Trouble in the rf amplifier subassembly can usually be isolated to a stage by observing front panel meter M601 (fig. 2) indications. The need for alignment can then be detected by a slight adjustment of the slugs when the meter indications are low. (Refer to paragraph 55*d* for normal meter indications.) Align the rf amplifier subassembly as follows:

a. Remove the left side panel cover from the transmitter and disconnect plug P304 from jack J401 on the rf amplifier subassembly (fig.

44).

b. Connect the transmitter to the maintenance kit (fig. 24).

c. Set the controls on the maintenance kit according to the chart in paragraph 55*c*(3).

d. Connect the maintenance kit to a 27.5-volt dc power source and observe the polarity.

e. Select the 60-watt range on the wattmeter and connect it to the ANT jack on the front panel.

f. Connect the rf signal generator to jack J401 on the transmitter and adjust the output frequency of the generator to 39.5 mc at 50,000 microvolts.

g. Turn meter switch S603 to I_G TRIP.

***Caution:* Prolonged keying of the transmitter may cause damage. When making the adjustments below, key the transmitter in intervals of 1 minute on and 1 minute off.**

h. Set the maintenance kit ON-OFF switch to ON and key the transmitter by setting the XMT-STBY switch to XMT.

i. Adjust the slugs in L401 and L402 (fig. 46) for maximum meter indication.

j. Turn the meter switch to I_G AMP. Adjust the slugs in L405 and L406 for maximum meter indication.

k. Turn the meter switch to I_G DR. Adjust the slug in L407 for maximum meter indication.

l. Turn the meter switch I PA. Adjust the slugs in L415 and C438 for maximum meter indication.

m. Adjust L417 (fig. 46) and C444 (fig. 47) for maximum power output indication on the wattmeter.

n. Tune the transmitter frequency to 135.0 mc with the frequency controls on the maintenance kit (fig. 22).

o. Tune the rf signal generator to 45 mc.

p. Repeat *h* through *m* above and check each stage by slightly adjusting each slug for maximum meter indication.

q. Turn off and disconnect all equipment.

r. Connect plug P304 to jack J401 on the rf amplifier subassembly (fig. 44) and replace the left side panel cover.

84. Alignment of Frequency Generator Subassembly

Note. Apply power to the transmitter (par. 83*b* through *d*).

Before aligning the frequency generator subassembly, complete all other circuit checks to be sure that alignment is necessary and that the crystal switches in each oscillator are properly aligned. To determine the need for alignment, measure the current at test point T.P.302 with the multimeter. Set the multimeter to the 250-microampere scale and measure the current for all channels. The current at T.P.302 should be not less than 10 to 15 microamperes for any channel. If the transmitter is only slightly out of tune (as indicated by near normal current), the procedure in *a* through *d* below need not be performed. In this case, perform the procedure in *f* through *h* below until normal current is indicated at T.P.302. If the current is far from normal, perform all the procedures below.

a. Set each of the eight trimmer capacitors in the frequency generator (C307, C313, C320, C325, C334, C341, C348, and C356) for minimum capacity. Minimum capacity is obtained when the screwdriver slot for each capacitor is vertical and the value marking is toward the back of the subassembly (fig. 49).

b. Set the slugs in each of the frequency generator coils (L302, L305, L306, L307, L310, and L312) so that the end of the slug nearest the slug rack is flush with the end of the coil form nearest the slug rack.

c. Adjust the voltmeter to measure frequencies below 20 mc and connect the probe to test point T.P.301 (fig. 48).

d. Set the transmitter to a frequency of 135.5 mc and make the following adjustments:

(1) Adjust C307 (fig. 49) for *maximum* indication on the voltmeter (approximately 11.8 volts).

(2) Adjust C313 for *minimum* indication on the voltmeter (approximately 7.8 volts).

(3) Adjust C320 for *maximum* indication on the voltmeter (approximately 8.2 volts).

(4) Adjust C325 for *minimum* indication on the voltmeter (approximately 8.0 volts).

e. Remove the voltmeter probe from T.P.301 and loosely couple the voltmeter to L310 by inserting the probe into the center of the coil. (It may be necessary to connect a 2-inch wire to the probe to secure enough coupling.) Make the following adjustments:

(1) Adjust C334 for *maximum* indication on the voltmeter (approximately 2.5 volts).
(2) Adjust C341 for *minimum* indication on the voltmeter (approximately 2.0 volts).
(3) Adjust C348 for *maximum* indication on the voltmeter (approximately 2.2 volts).

f. Set the multimeter to the 250-microampere scale and connect the probe to T.P.302 (fig. 48).

g. Set the transmitter at a frequency of 135.0 mc and measure the current. The current should be approximately 25 microamperes.

h. Set the transmitter at a frequency of 135.95 mc and measure the current. The current should be approximately 20 microamperes.

i. Set the transmitter at a frequency of 118.5 mc. Adjust the slugs (fig. 49) in L302, L305, L306, L307, L310, L311, and L312, in that order, for maximum current at T.P.302.

j. Set the transmitter at a frequency of 135.5 mc. Adjust C313, C320, C325, C334, C341 and C348, in that order, for maximum current indication at T.P.302.

k. Repeat *i* and *j* above, in order, until no readjustment is necessary.

l. With the slugs positioned as indicated in *i* above, set the transmitter to a frequency of 127.5 mc and adjust C356, connected across L316, for maximum indication on the front panel meter in the I_G TRIP position. (Tuning of L401 and L402 also affects this reading; be sure that they are properly adjusted.) Check the meter indication with the transmitter frequency set at 135.5 and 118.0 mc. A slight retuning of L316 and L356 may be made to improve indication at both frequencies.

CHAPTER 5

FINAL TESTING

Section I. FOURTH ECHELON TESTING PROCEDURES

85. General

a. Testing procedures are prepared for use by Signal Field Maintenance Shops and Signal Service Organizations responsible for fourth echelon maintenance to determine the acceptability of repaired signal equipment. These procedures set forth specific requirements that repaired signal equipment *must meet* before it is returned to the using organization. The testing procedures may also be used as a guide for testing equipment that has been repaired at third echelon if the proper tools and test equipment are available. A summary of the performance standards is given in paragraph 95.

b. Comply with the instructions preceding the body of the chart before proceeding to the chart. Perform each test in sequence. Do not vary the sequence. For each step, perform all actions required in the *Test equipment control settings* and *Equipment under test control settings* columns; then perform each specific test procedure and verify it against its performance standard.

86. Test Equipment, Tools, and Materials

All test equipment, tools, materials, and other equipment required to perform the testing procedure given in the section are listed in the following charts and are authorized under TA 11–17 and TA 11–100(11–17), except as noted.

a. Test Equipment.

Nomenclature	Federal stock No.	Technical reference
Electronic Equipment Maintenance Kit MK–430/ART	To be assigned	Paragraphs 42 through 50
RF Wattmeter AN/URM–43(*)[a]	6625–635–9186	TM 11–5133
Multimeter TS–352(*)/U[b]	6625–242–5023	TM 11–5527
Audio Oscillator TS–382(*)/U[c]	6625–192–5094	TM 11–2684A
Output Meter TS–585(*)/U[d]	6625–244–0501	TM 11–5017
Electronic Multimeter ME–30(*)/U[e]	6625–669–0742	TM 11–5132
Oscilloscope OS–8(*)/U[f]	6625–568–4898	TM 11–1214A
Spectrum Analyzer TS–723(*)/U[g]	6625–668–9418	TM 11–5097

[a]Indicates AN/URM–43A or AN/URM–43C.

[b]Indicates TS–352/U, TS–352A/U, or TS–352B/U.

[c]Indicates TS–382A/U, TS–382B/U, TS–382D/U, TS382E/U, or TS–382F/U.

[d]Indicates TS–585B/U, TS–585C/U, or TS–585D/U.

[e]Indicates ME–30A/U, ME–30B/U, or ME–30C/U.

[f]Indicates OS–8B/U, OS–8C/U, or OS–8E/U.

[g]Indicates TS–723/U, TS–723A/U, or TS–723B/U.

b. Other Equipment and Materials.

Nomenclature	Federal stock No.	Technical reference
Power Supply PP–1104A/G	6130–542–6385	TM 11–5126
Radio Receiver R–220/URR	5820–642–8144	TM 11–882
Headset HS–30–U	5965–164–7259	None
Cord CD–605 (Required for HS–30–U)	6625–170–9608	None
Cord CG–92B/U (p/o TS–118A/AP)	6625–503–2372	TM 11–1036A
Cord Assembly, Electrical CD–1252	5995–284–6306	None
	6145–548–1266	None
	5935–192–4753	None
Microphone, Carbon M–52/U	5965–646–4678	None
Hookup wire, No. 20 AWG[a] (approximately six feet long)	6145–160–5317	None

[a]Any No. 20 AWG hookup wire may be used.

87. Test Facilities

A dc power supply capable of supplying 15 amperes and output voltage which can be varied from 24 to 29 volts, is required to power the equipment for these tests. The power supply listed in paragraph 86*b*, or any other source of power capable of meeting the requirements, may be used.

88. Special Requirements

The labeling of certain controls differs on Audio Oscillator TS–382A/U from other models of this equipment. Reference to the control and control settings in the charts applies to the TS–382B/U, TS–382D/U, TS–382E/U, and TS–382F/U.

89. Physical Tests and Inspection

a. Test Equipment and Materials. None required.

b. Test Connections and/or Conditions. No connections to the transmitter are required for this test. The front panel cover must be removed from the transmitter for this test.

c. Test Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	N/A	Controls may be in any position.	Check the METER SELECTOR SWITCH for correct operation.	Switch should operate freely without binding.
2	N/A	Controls may be in any position.	Inspect the front panel meter for broken glass and damaged pointer.	Meter should be in good condition.
3	N/A	Controls may be in any position.	*a.* Inspect all connectors, neon lamps (NE 601 and NE 602, fig. 2), and cover plates for damaged or missing parts. Inspect entire case for missing screws, nuts, and bolts. b. Inspect transmitter for condition of finish and panel markings.	*a.* Connectors, neon lamps, and cover plates should be in good condition. There should be no missing hardware. b. Surfaces intended to be painted should show no bare metal. Panel markings should be legible. *Note.* Touchup painting is recommended instead of refinishing, whenever practicable. Screwheads, receptacles, and carrying handles should not be painted or polished with abrasives.

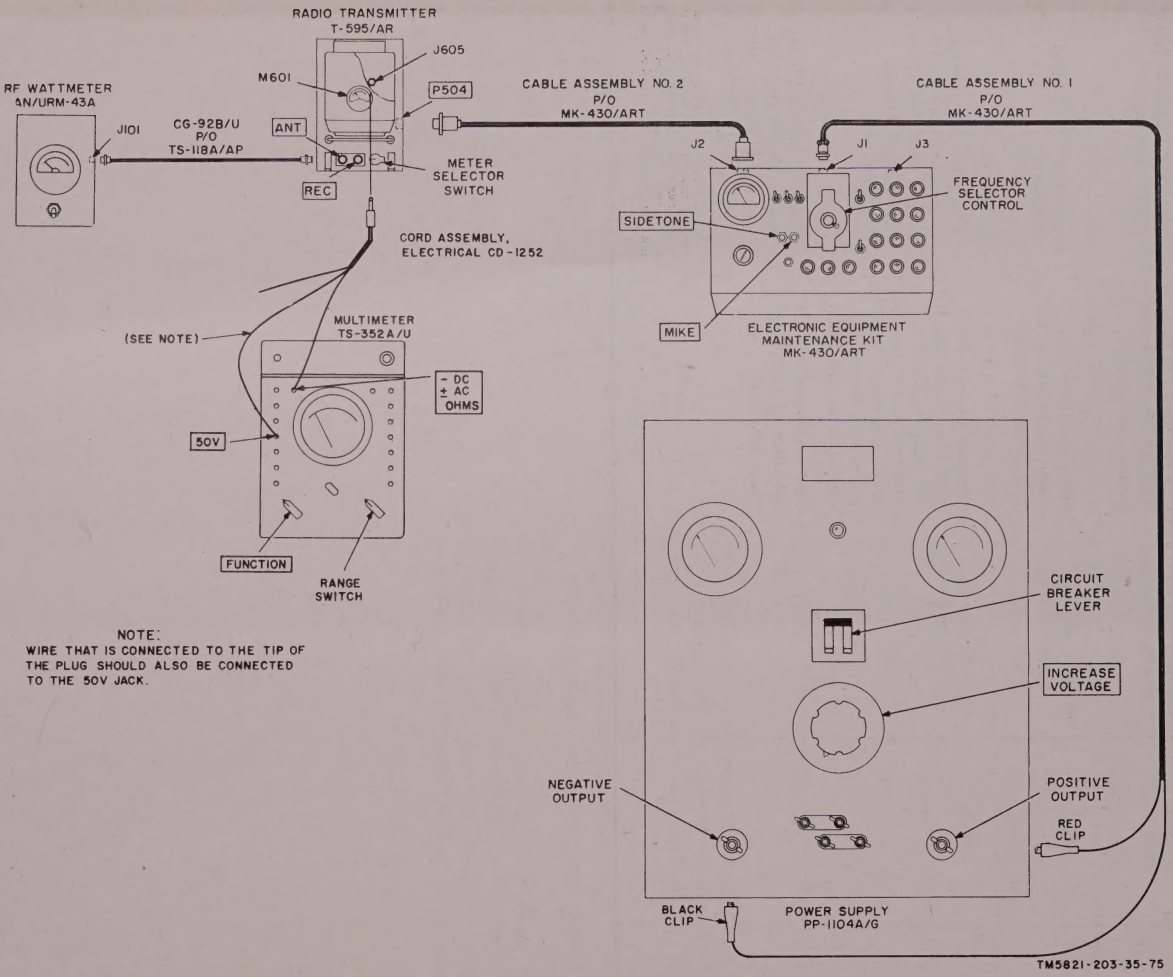


Figure 61. Tuning capability and power output tests connections.

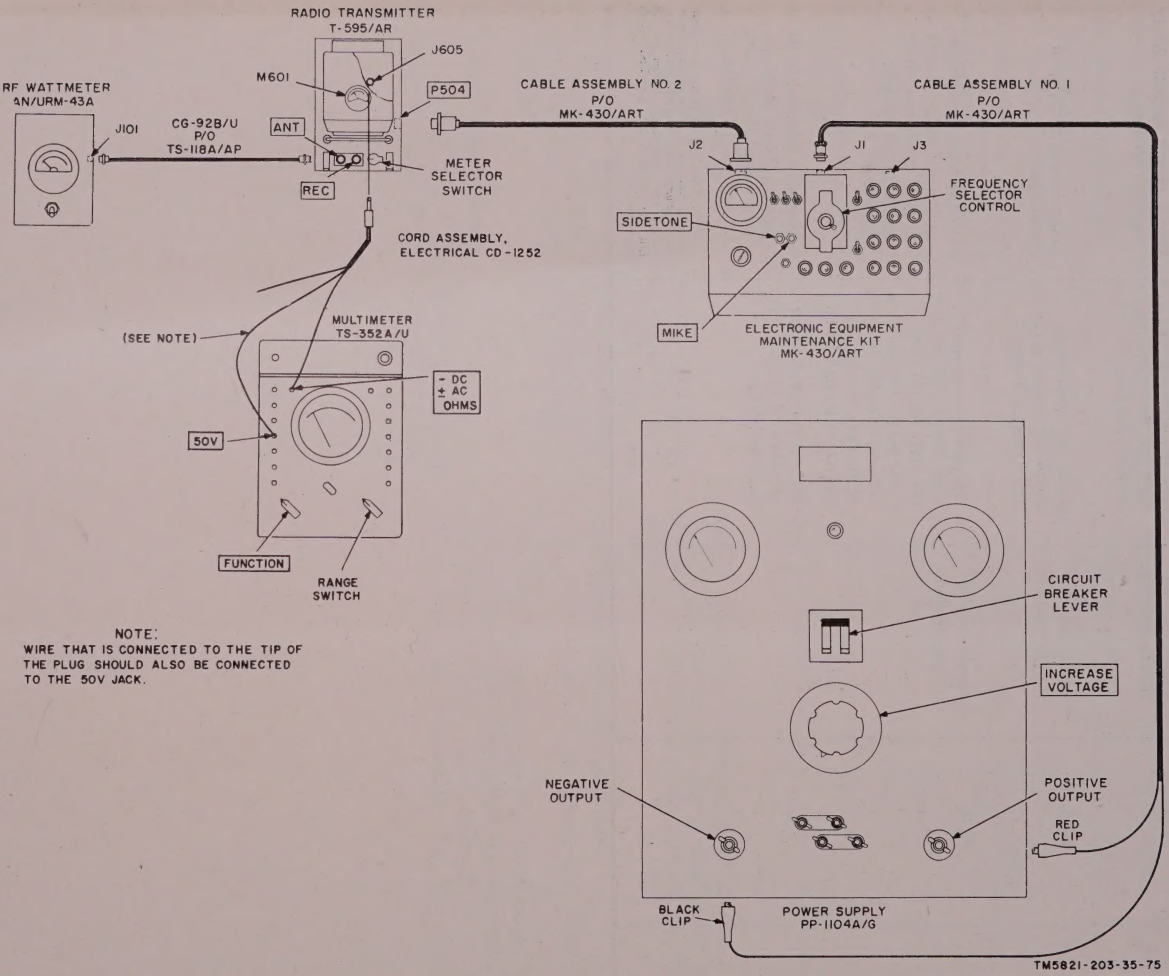


Figure 61. Tuning capability and power output tests connections.

90. Tuning Capability and Power Output Tests

a. Test Equipment and Materials.

Electronic Equipment Maintenance Kit MK–430/ART
Power Supply PP–1104A/G
Cord Assembly, Electrical CD–1252
RF Wattmeter AN/URM–43A/U
Multimeter TS–352A/U

b. Test Connections and/or Conditions. Do not connect the equipment until instructed in the test procedure.

c. Test Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*TS–352A/U* FUNCTION: OHMS RANGE: RX1	Controls may be in any position.	*a.* Connect the test leads to the terminals –DC =AC OHM on the TS–352A/U.	*a.* None.
			b. Touch the remaining two ends of the test prods together.	*b.* None.
			c. Adjust the OHMS ZERO ADJ until the meter indicates ZERO on the top scale.	*c.* None.
			d. Connect one of the test prods to the inner conductor of the connector marked ANT on the transmitter. Connect the remaining test prod to the inner conductor of the connector marked REC on the transmitter. Note the indication on the TS–352A/U.	*d.* TS–352A/U should indicate not more than 1 ohm.
			e. Disconnect the test prods from the transmitter.	*e.* None.
2	*MK–430/ART* 27 VDC ON-OFF: OFF ACFT POWER-EXT POWER: EXT POWER 27 VDC-ADJ DC: ADJ DC Frequency selector control: 118.0 DCD-SCS: SCS XMT-STBY: STBY ADJUST DC: fully counterclockwise	METER SELECTOR SWITCH: BAT SIDETONE LEVEL: fully clockwise	*a.* Connect the equipment as shown in figure 61.	*a.* None.
			b. Set the circuit breaker lever on the power supply to ON and turn the INCREASE VOLTAGE control until the D.C. VOLTMETER indicates 27 volts.	*b.* None.
			c. Set the ON-OFF switch on the MK–430/ART to ON. *Note.* It may be necessary to wait a few seconds until the transmitter completes its frequency selection before continuing with the test.	*c.* None.
	PP–1104A/G Circuit breaker lever: OFF INCREASE VOLTAGE: fully counterclockwise. *TS–352A/U* FUNCTION: DIRECT *AN/URM–43A* 60W-15W: 60W		*d.* Turn the ADJUST DC control until meter M–601 on the transmitter indicates 5 (red line). Note the indication on the TS–352A/U.	*d.* TS–352A/U should indicate between 25.5 and 27.5 volts.
			e. Note the indication on the transmitter frequency indicators. ***Caution:* The XMT–STBY switch on the MK–430/ART should not be allowed to remain in the XMT position longer than 1 minute, because prolonged keying of the transmitter may damage the equipment.**	*e.* The transmitter frequency indicators should indicate 118 on the whole megacycle indicator and 00 on the tenth megacycle indicator.
			f. Set the XMT–STBY switch on the MK–430/ART to XMT. Note the indication on the AN/URM–43A.	*f.* AN/URM–43A should indicate not less than 20 watts.
			g. Note the indication on the D. C. AMMETER of the PP–1104A/G.	*g.* DC AMMETER should indicate not more than 12.5 amperes.
			h. Set the XMT–STBY switch on the MK–430/ART to STBY.	*h.* None.
3	Same as step No. 2 except: *MK–430/ART* Frequency selector control: 126.5 27 VDC ON-OFF: ON	Same as step No. 2	*a.* Set the XMT–STBY switch on the MK–430/ART to XMT. Note the indication on the AN/URM–43A.	*a.* AN/URM–43A should indicate not less than 20 watts.
			b. Set the XMT–STBY switch on the MK–430/ART to STBY.	*b.* None.
			c. Note the indication on the transmitter frequency indicators.	*c.* The transmitter frequency indicators should indicate 126 on the whole megacycle and 0.50 on the tenth megacycle indicator.
4	Same as step No. 2 except: *MK–430/ART* Frequency selector control: 135.95 27 VDC ON-OFF: ON	Same as step No. 2	*a.* Set the XMT–STBY switch on the MK–430/ART to XMT. Note the indication on the AN/URM–43A.	*a.* AN/URM–43A should indicate not less than 20 watts.
			b. Set the XMT–STBY switch on the MK–430/ART to STBY.	*b.* None.
			c. Note the indication on the transmitter frequency indicators.	*c.* The transmitter frequency indicators should indicate 135 on the whole megacycle indicator and 0.95 on the tenth megacycle indicator.
5	Same as step No. 2 except: *MK–430/ART* Frequency selector control 135.95 27V ON-OFF: ON	Same as step No. 2	*a.* Turn the INCREASE VOLTAGE control on the PP–1104A/G until the D. C. VOLTMETER indicates 24 volts.	*a.* None.
			b. Set the frequency selector control on the MK–430/ART to 126.5 mc. Note the indication on the transmitter frequency indicators.	*b.* The transmitter frequency indicators should indicate 126 on the whole megacycle and 50 on the tenth megacycle indicator.
			c. Set the frequency selector control on the MK–430/ART to 118.0 mc. Note the indication on the transmitter frequency indicators.	*c.* The transmitter frequency indicators should indicate 118 on the whole megacycle and 00 on the tenth megacycle indicator.
			d. Adjust the INCREASE VOLTAGE control on the PP–1104A/G until the meter indicates 27 volts.	*d.* None.
			e. Set the DCD–SCS switch on the MK–430/ART to DCD. Note the indication on the transmitter frequency indicators.	*e.* The transmitter frequency indicators should indicate 124 on the whole megacycle and 00 on the tenth megacycle indicator.
			f. Set the 27 VDC ON-OFF switch on the MK–430/ART to OFF and the DCD–SCS switch to SCS.	*f.* None.

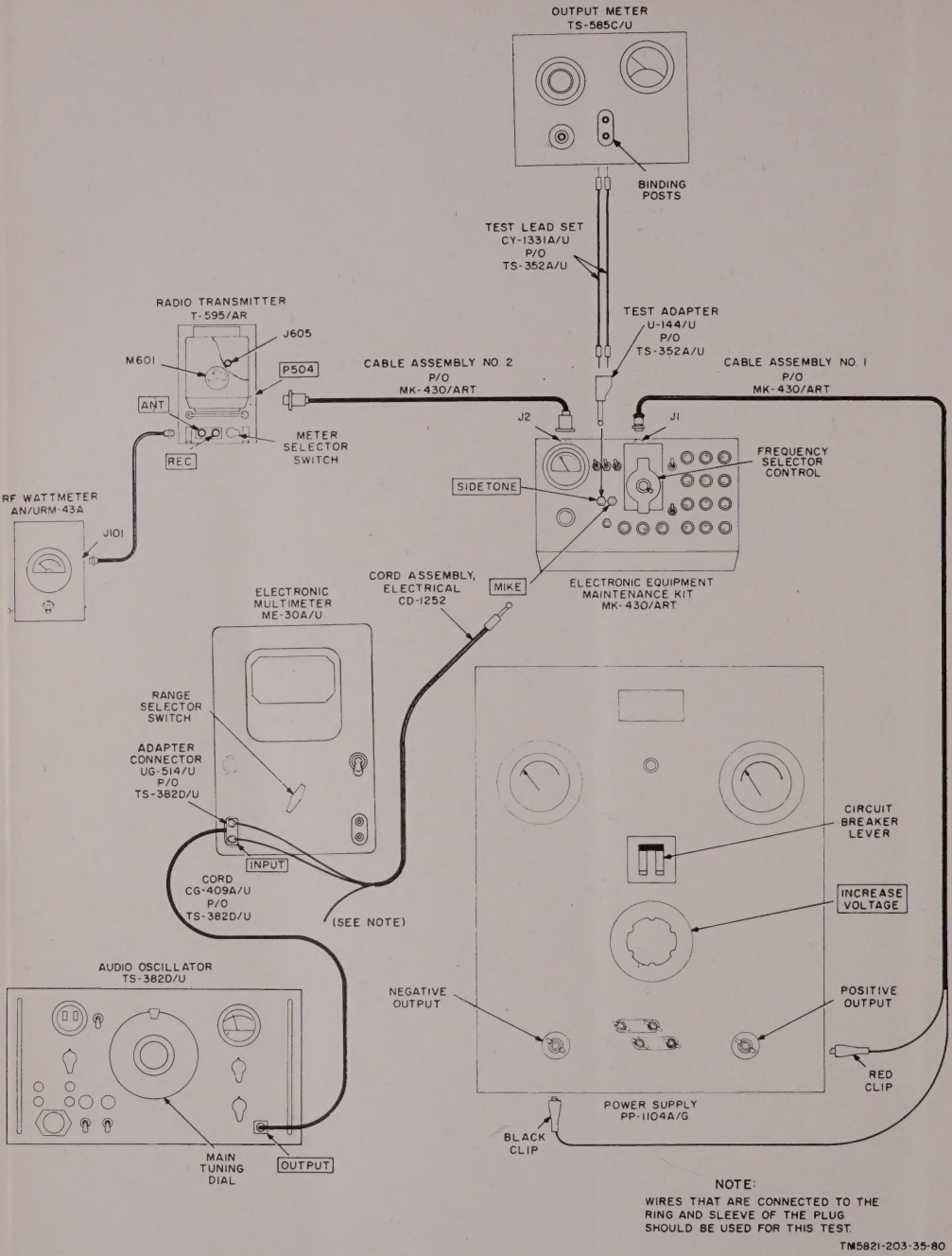


Figure 62. Sidetone tests connections.

91. Sidetone Tests

a. Test Equipment and Materials.

Electronic Equipment Maintenance Kit MK–430/ART
Power Supply PP–1104A/G
RF Wattmeter AN/URM–43A
Audio Oscillator TS–382D/U
Output Meter TS–585C/U
Cord CG–92B/U (p/o TS–118A/AP)
Electronic Multimeter ME–30A/U
Cord Assembly, Electrical CD–1252

b. Test Connections and/or Conditions. Connect the equipment as shown in figure 62.

c. Test Procedure. ,

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*MK–430/ART* 27 VDC ON-OFF: OFF ACFT POWER-EXT POWER 27 VDC-ADJ DC: ADJ DC Frequency selector control: 118.0 DCD–SCS: SCS XMT–STBY: STBY *PP–1104A/G* Circuit breaker lever: ON *AN/URM–43A* 60W–15W: 60W *TS–382D/U* HEATER: ON OSC: ON FREQUENCY MULTIPLIER: X10 FREQUENCY METER: OFF Main tuning dial: 100 OUTPUT CONTROL: fully counterclockwise OUTPUT MULTIPLIER: 1 *TS–585C/U* Impedance control: 50 (X10 bracket) MULTIPLY BY: X10 *ME–30A/U* Power switch: ON Range selector switch: 1	METER SELECTOR SWITCH: BAT. SIDE TONE LEVEL: fully clockwise	*a.* Set the 27 VDC ON-OFF switch on the MK–430/ART to ON. *b.* Adjust the OUTPUT CONTROL on the audio oscillator until the ME–30A/U indicates 0.25 volts (0.25 on the 0–1.0 scale). ***Caution:* The XMT–STBY switch on the MK–430/ART should not be allowed to remain in the XMT position longer than 1 minute, since prolonged keying of the transmitter can result in damage to the equipment.** *c.* Set the XMT–STBY switch on the MK–ART to XMT. Note the indication on the meter of the TS–585C/U. *d.* Set the XMT–STBY switch to STBY and the 27 VDC ON-OFF switch on the MK–430/ART to OFF.	*a.* None *b.* None *c.* The TS–585C/U meter should indicate not less than 50 milliwatts (5 on the 0-50 scale). *d.* None

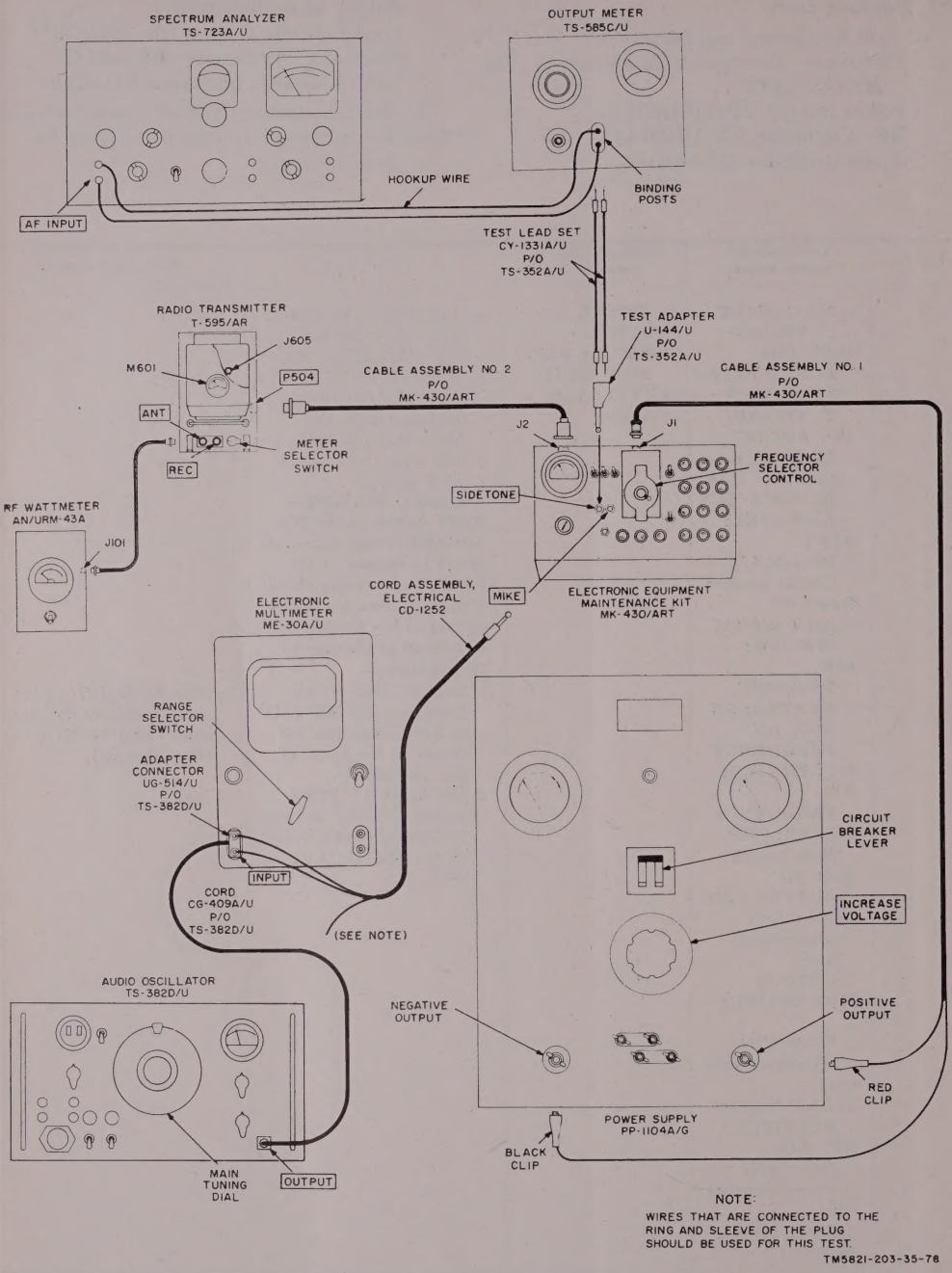


Figure 64. Modulation distortion test connections.

93. Modulation Distortion Test

a. Test Equipment and Materials.

Electronic Equipment Mainte
MK–430/ART
Power Supply PP–1104A/G
Output Meter TS–585C/U
Audio Oscillator TS–382D/U

Step No.	Test equipment control settings	Equipmen control
1	*MK–430/ART* 27 VDC ON-OFF: OFF ACFT POWER: EXT POWER 27 VDC–ADJ DC: Frequency selector control: 118.0 DCD–SCS: SCS XMT–STBY: STBY *PP–1104A/G* Circuit breaker lever: ON *AN/URM–43A* 60–15: 60W *TS–585C/U* Impedance control: 50 (X10 bracket) MULTIPLY BY: 10 *TS–382D/U* HEATER: ON OSC: ON Frequency multiplier: X10 FREQUENCY METER: OFF Main tuning dial: 100	METE SELECT SWITCH SIDET LEVEL clockwise

Test procedure	Performance standard
(4) Adjust the TS–723A/U lower FREQUENCY control (FINE) for minimum meter indication on the meter. (5) Adjust the TS–723A/U BALANCE control for minimum indication on the meter. (6) Repeat (4) and (5) above until no further interaction occurs. (7) Note the distortion as indicated on the TS–723A/U meter. Set the XMT–STBY witch to the MK–30/ART to STBY.	

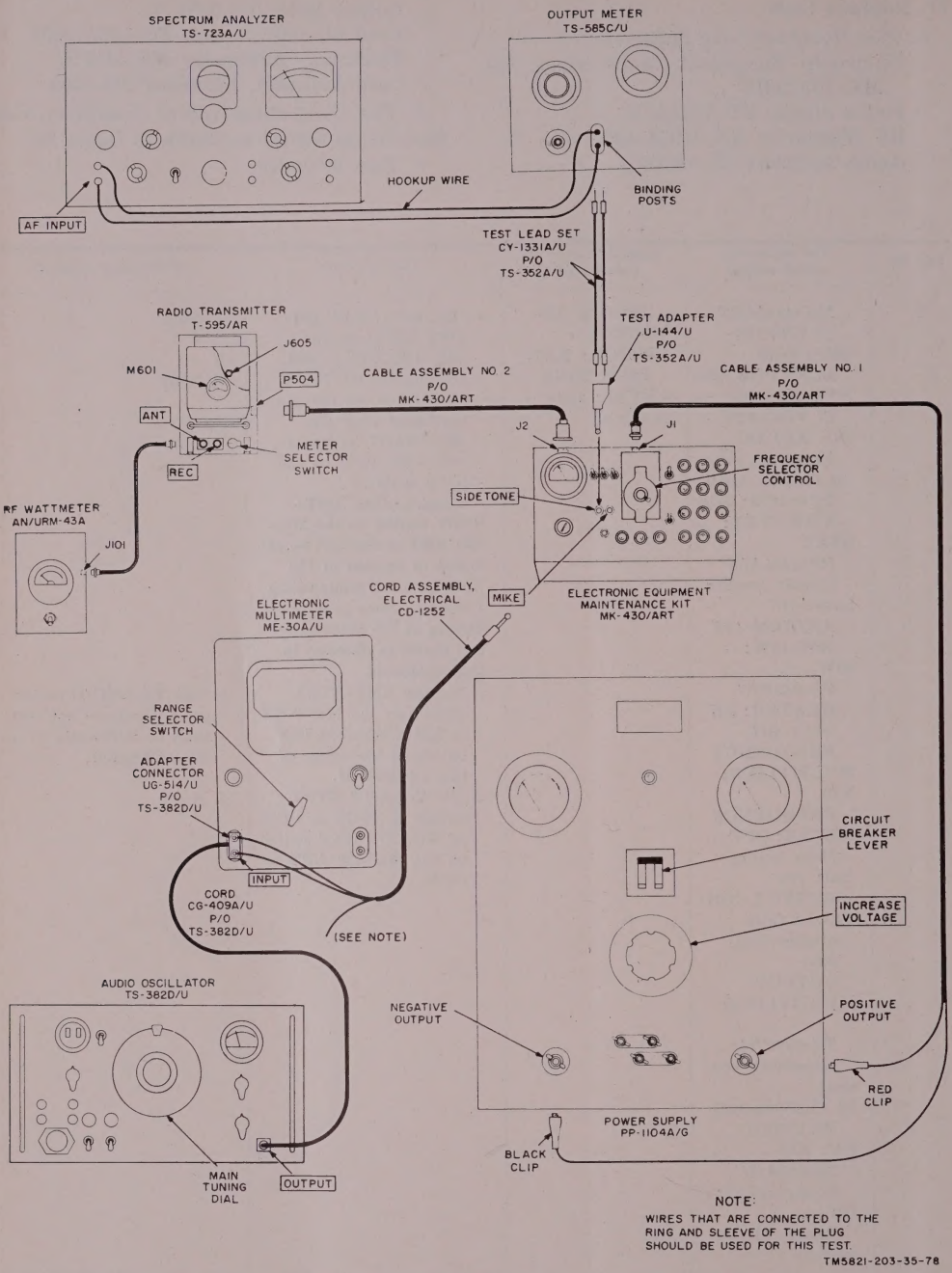


Figure 64. Modulation distortion test connections.

93. Modulation Distortion Test

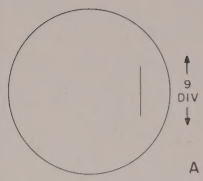
a. Test Equipment and Materials.

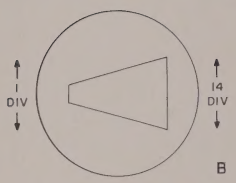
Electronic Equipment Maintenance Kit MK–430/ART
Power Supply PP–1104A/G
Output Meter TS–585C/U
Audio Oscillator TS–382D/U
Spectrum Analyzer TS–723A/U
RF Wattmeter AN/URM–43A
Cord CG–92B/U (p/o TS–118A/AP)
Cord Assembly, Electrical CD–1252
Electronic Multimeter ME–30A/U

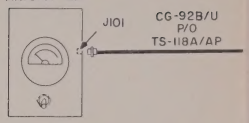
b. Test Connections and/or Conditions. Connect equipment as shown in figure 64.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*MK–430/ART* 27 VDC ON-OFF: OFF ACFT POWER: EXT POWER 27 VDC–ADJ DC: Frequency selector control: 118.0 DCD–SCS: SCS XMT–STBY: STBY *PP–1104A/G* Circuit breaker lever: ON *AN/URM–43A* 60–15: 60W *TS–585C/U* Impedance control: 50 (X10 bracket) MULTIPLY BY: 10 *TS–382D/U* HEATER: ON OSC: ON Frequency multiplier: X10 FREQUENCY METER: OFF Main tuning dial: 100	METER SELECTOR SWITCH: BAT SIDETONE LEVEL: fully clockwise	*a.* Set the 27 VDC ON-OFF switch on the MK–430/ART to ON. *b.* Adjust the OUTPUT CONTROL on the audio oscillator until the ME–30A/U indicates 0.25 volt (0.25 on the 0–1.0 scale). ***Caution:* The XMT–STBY switch on the MK–430/ART should not be allowed to remain in the XMT position longer than 1 minute since prolonged keying of the transmitter can result in damage to this equipment.** *c.* Set the XMT–STBY switch on the MK–430/ART to XMT. *d.* Measure the distortion as follows: (1) Slowly rotate INPUT control on the TS–723A/U until the TS–723A/U meter indicates full-scale deflection (1.0). (2) Turn the FUNCTION switch on the TS–723A/U to DISTORTION. (3) Adjust the TS–723A/U upper FREQUENCY control (coarse) until a sharp dip is indicated by the meter needle.	*a.* None. *b.* None. *c.* None. *d.* Indication on the TS–723A/U meter should not exceed 10% (0.1 on the 0 to 1.0 scale).

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
	OUTPUT CONTROL: fully counterclockwise OUTPUT MULTIPLIER: 1 *TS–723A/U* ON-OFF: ON INPUT: MIN AF–RF: AF RANGE: X10 FREQUENCY: 100 on tuning dial FUNCTION: SET LEVEL METER RANGE SWITCH: 100% BALANCE: fully counterclockwise		(4) Adjust the TS–723A/U lower FREQUENCY control (FINE) for minimum meter indication on the meter. (5) Adjust the TS–723A/U BALANCE control for minimum indication on the meter. (6) Repeat (4) and (5) above until no further interaction occurs. (7) Note the distortion as indicated on the TS–723A/U meter. *e.* Set the XMT–STBY switch to the MK–430/ART to STBY.	







NOTES:

1. JUMPER WIRE MUST BE REMOVED FROM TERMINALS MARKED AMP AND D3 AND CONNECTED AS SHOWN ABOVE.
2. JUMPER WIRE MUST BE REMOVED FROM TERMINALS MARKED AMP AND D4 AND CONNECTED AS SHOWN ABOVE.
3. HOOKUP WIRE SHOULD HAVE A TWO TURN LOOP APPROXIMATELY 3/8" DIAMETER ON ONE END, WITH THE LOOP POSITIONED AT RIGHT ANGLE TO THE WIRE.
4. WIRES THAT ARE CONNECTED TO RING AND SLEEVE OF PLUG SHOULD BE USED FOR THIS TEST.

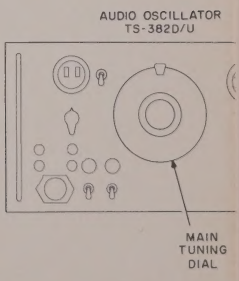
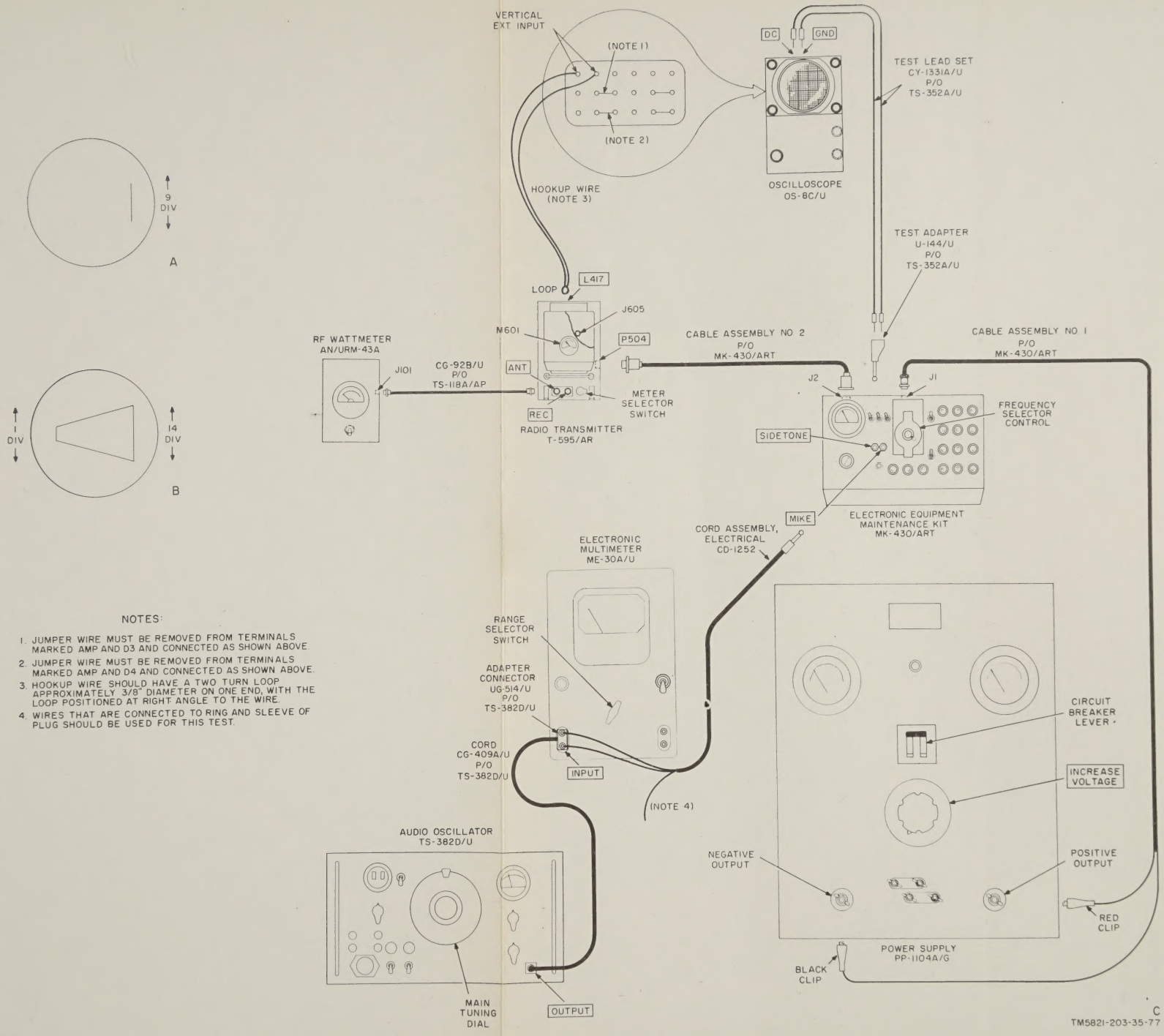


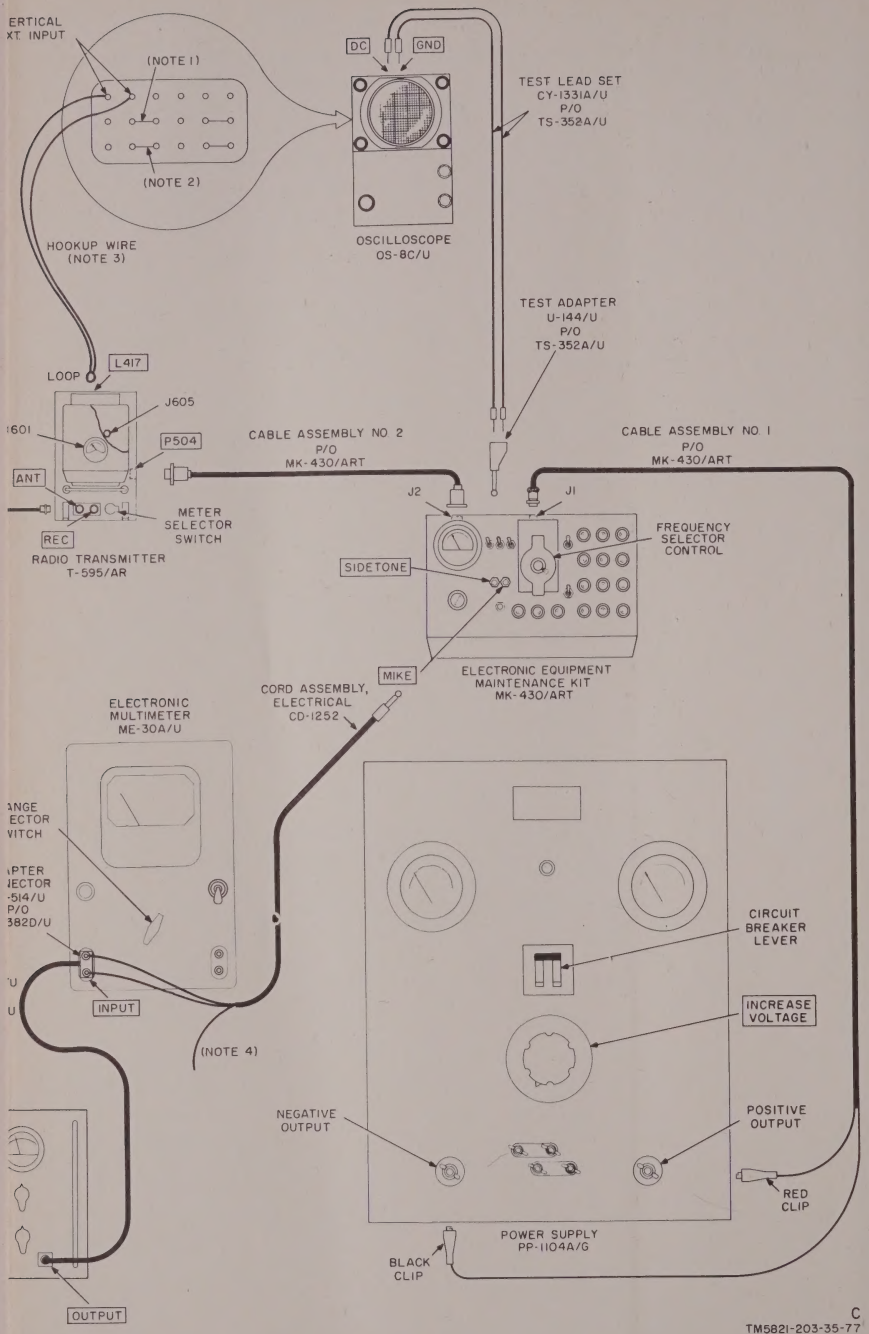
Figure 63. M



NOTES:

1. JUMPER WIRE MUST BE REMOVED FROM TERMINALS MARKED AMP AND D3 AND CONNECTED AS SHOWN ABOVE.
2. JUMPER WIRE MUST BE REMOVED FROM TERMINALS MARKED AMP AND D4 AND CONNECTED AS SHOWN ABOVE.
3. HOOKUP WIRE SHOULD HAVE A TWO TURN LOOP APPROXIMATELY 3/8" DIAMETER ON ONE END, WITH THE LOOP POSITIONED AT RIGHT ANGLE TO THE WIRE.
4. WIRES THAT ARE CONNECTED TO RING AND SLEEVE OF PLUG SHOULD BE USED FOR THIS TEST.

Figure 63. Modulation capability test connections.



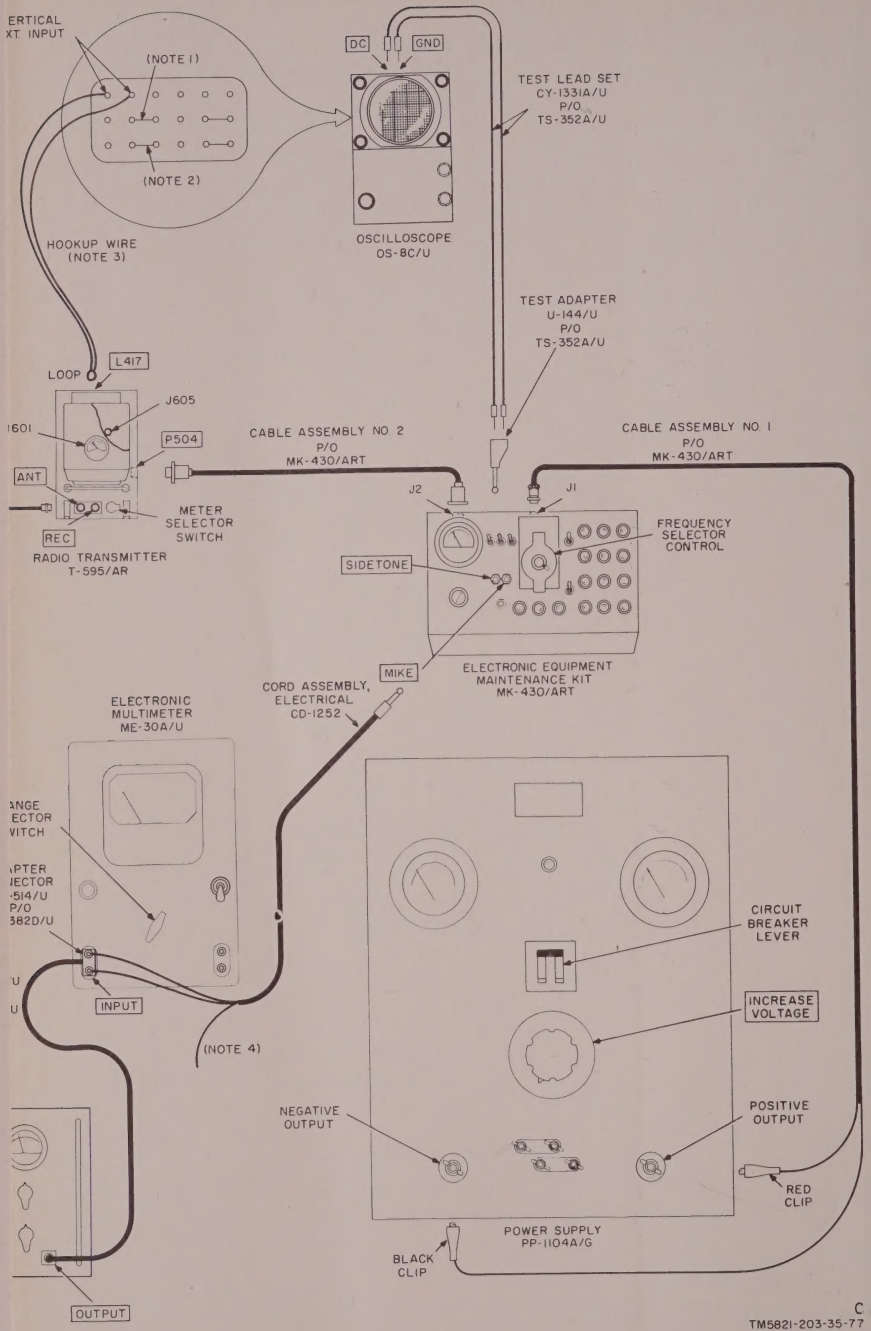
odulation capability test connections.

Modulation Capability Test

i. Test Equipment and Materials.

Electronic Equipment Maintenance K
MK–430/ART
Power Supply PP–1104A/G
RF Wattmeter AN/URM–43A
Audio Oscillator TS–382D/U
Oscilloscope OS–8C/U
Cord Assembly, Electrical CD–1252
Cord CG–92B/U (p/o TS–118A/AP)

o No.	Test equipment control settings	Equipment under test control settings	cedure	Performance standard
			e loop of the e through the of the trans- ed L–417 and loop in the e coil form ne of the l with the the coil. Do the position of hookup he following are com-	*f.* None.
1	*MK–430/ART* 27 VDC ON-OFF: OFF ACFT POWER-EXT POWER: 27 VDC-ADJ DC: ADJ Frequency selector control: 118.0 DCD–SCS–SCS XMT–STBY: STBY PP–1104A/G Circuit breaker lever: ON *AN/URM–43A* 60W–15W: 60W *TS–382D/U* HEATER: ON OSC: ON FREQUENCY MULTIPLIER: X10 FREQUENCY METER: OFF Main tuning dial: 100	METER SELECTOR SWITCH: BAT SIDELINE LEVEL: fully clockwise	IT-STBY he MK– XMT and op of hookup lown until trace covers sions of the tube screen A, figure IT–STBY he MK– STBY. CD–1252 MIKE jack 430/ART and e test lead terminal of U. IT–STBY he MK– XMT. OUTPUT on the audio til the pat- oscilloscope all division num point ll divisions num point as figure 63. T–STBY e MK– STBY. Note n on the	*g.* None. *h.* None. *i.* None. *j.* None. *k.* None. *l.* Indication on ME–30A/U should be within the following limits: 0.22 to (0–1.0 scale) 0.28 volt. (Indicates 90% ±5% modulation.)



odulation capability test connections.

. Modulation Capability Test

a. Test Equipment and Materials.

Electronic Equipment Maintenance Kit MK–430/ART
Power Supply PP–1104A/G
RF Wattmeter AN/URM–43A
Audio Oscillator TS–382D/U
Oscilloscope OS–8C/U
Cord Assembly, Electrical CD–1252
Cord CG–92B/U (p/o TS–118A/AP)
Electronic Multimeter ME–30A/U
Hookup wire, No. 20 AWG (approximately 6 feet long)

b. Test Connections and/or Conditions. Connect equipment as shown in C, figure 63. Do not connect the OS–8C/U to the transmitter until instructed to do so in the test procedure. Remove plug button from the top of the transmitter marked L–417.

c. Test Procedure.

tep No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*MK–430/ART* 27 VDC ON-OFF: OFF ACFT POWER-EXT POWER: 27 VDC-ADJ DC: ADJ Frequency selector control: 118.0 DCD–SCS–SCS XMT–STBY: STBY PP–1104A/G Circuit breaker lever: ON *AN/URM–43A* 60W–15W: 60W *TS–382D/U* HEATER: ON OSC: ON FREQUENCY MULTIPLIER: X10 FREQUENCY METER: OFF Main tuning dial: 100	METER SELECTOR SWITCH: BAT SIDELINE LEVEL: fully clockwise	*a.* Adjust the INT, FOCUS, HOR POS, and VERT POS controls on the OS–8C/U until the trace (a single spot) is centered on the screen. ***Caution:* To prevent burning the screen of the cathode-ray tube, adjust the INT. control so that the trace is no brighter than necessary to be easily seen with the light shield extended.**	*a.* None.
			b. Adjust the HOR POS on the OS–8C/U until the trace (a single spot) appears on the left-hand side of the screen, in the center of the 0 of the oscilloscope overlay grid.	*b.* None.
			c. Connect the OS–8C/U to the transmitter as shown in C, of figure 63.	*c.* None.
			d. Disconnect the CD–1252 plug from the MIKE jack on the MK–430/ART.	*d.* None.
			e. Disconnect the test lead from the DC terminal of the OS–8C/U.	*e.* None.
	OUTPUT CONTROL: fully counterclockwise. OUTPUT MULTIPLIER: 1 *ME–30A/U* Range selector switch: 1 Power switch: ON *OS–8C/U* VERT ATTEN: DC VERT GAIN: 1 HOR ATTEN: DC HOR GAIN: 1 COARSE FREQUENCY: can be in any position. VERNIER FREQUENCY: can be set in any position. SYNC SELECTOR: EXT LOCKING: can be in any position.		*f.* Position the loop of the hookup wire through the hole on top of the transmitter labeled L–417 and position the loop in the center of the coil form with the plane of the loop parallel with the windings of the coil. Do not disturb the position of the loop of hookup wire until the following procedures are completed.	*f.* None.
			g. Set the XMT-STBY switch on the MK–430/ART to XMT and move the loop of hookup wire up or down until the vertical trace covers 9 small divisions of the cathode-ray tube screen as shown in A, figure 63.	*g.* None.
			h. Set the XMT–STBY switch on the MK–430/ART to STBY.	*h.* None.
			i. Replace the CD–1252 plug in the MIKE jack on the MK–430/ART and reconnect the test lead to the D. C. terminal of the OS–8C/U.	*i.* None.
			j. Set the XMT–STBY switch on the MK–430/ART to XMT.	*j.* None.
			k. Adjust the OUTPUT CONTROL on the audio oscillator until the pattern on the oscilloscope covers 1 small division at the minimum point and 14 small divisions at the maximum point as shown in B, figure 63.	*k.* None.
			l. Set the XMT–STBY switch on the MK–430/ART to STBY. Note the indication on the ME–30A/U.	*l.* Indication on ME–30A/U should be within the following limits: 0.22 to (0–1.0 scale) 0.28 volt. (Indicates 90% ±5% modulation.)

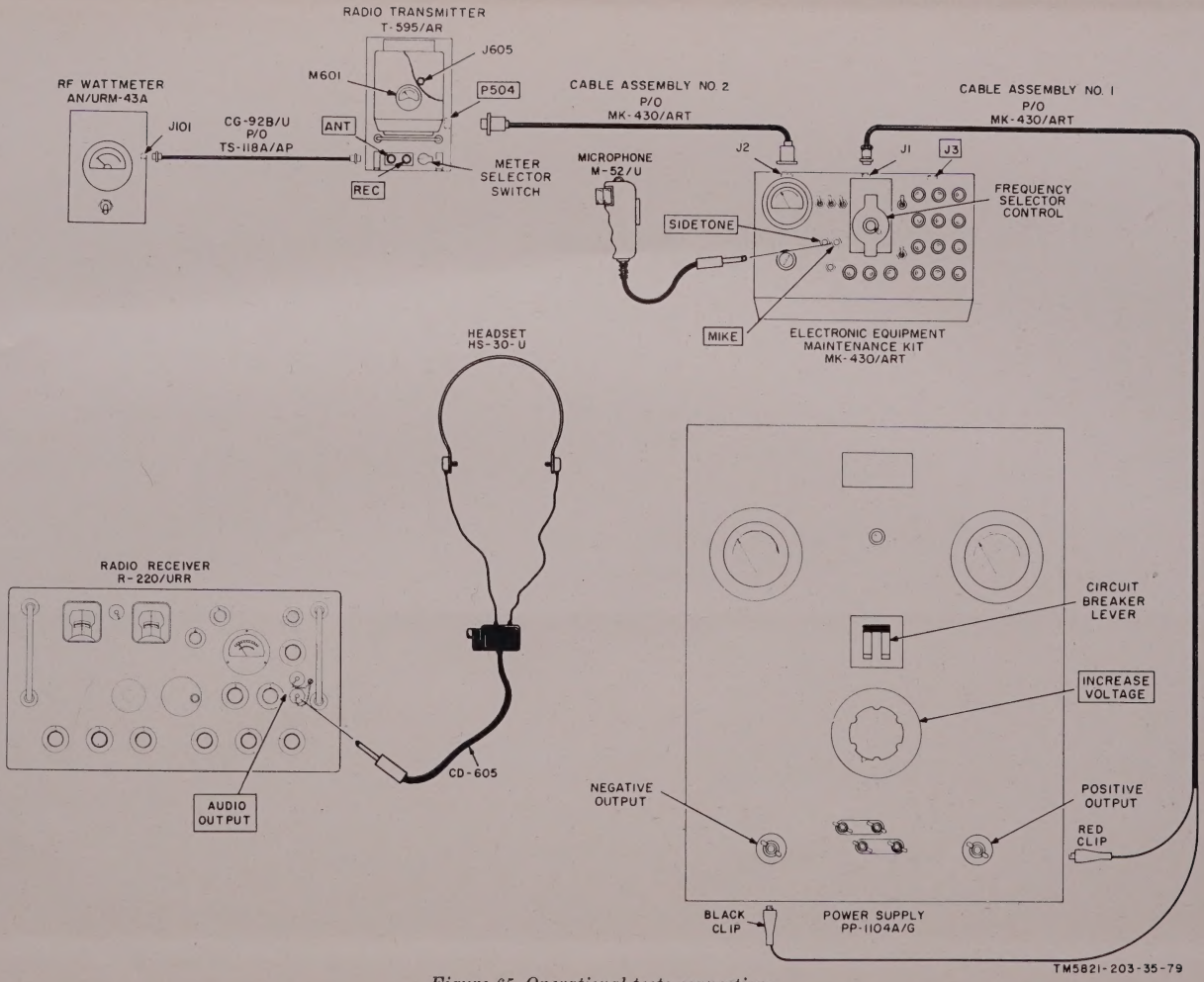


Figure 65. Operational tests connections.

94. Operational Tests

a. Test Equipment and Materials.

Electronic Equipment Maintenance Kit MK–430/ART
Power Supply PP–1104A/G
RF Wattmeter AN/URM–43A
Radio Receiver R–220/URR
Headset HS–30–U
Cord CD–605 (used with HS–30–U)
Cord CG–92B/U (p/o TS–118A/AP)
Microphone, Carbon M–52/U

b. Test Connections and/or Conditions. Connect equipment as shown in figure 65.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
	MK–430/ART ON-OFF: ON ACFT POWER-EXT POWER: EXT POWER 27 VDC-ADJ DC: ADJ DC Frequency selector control: 118.0 DCD–SCS: SCS XMT–STBY: STBY *PP–1104A/G* circuit breaker lever: ON *AN/URM–43A* 60W–15W: 60W *R–220/URR* OPERATION: AGC B. F. OSCILLATOR: OFF NOISE LIMITER: OFF AUDIO RESPONSE: WIDE SELECTIVITY: 10 R. F. GAIN-SQUELCH: Fully clockwise BAND SELECTOR: 6 TUNING: 118.0 on tuning dial AUDIO GAIN 1: midrange AUDIO GAIN 2 midrange METER: CARRIER DIAL LIGHT: OFF CALIBRATE: OFF	METER SELECTOR SWITCH: BAT SIDETONE LEVEL: fully clockwise	*a.* Use an assistant to speak into the microphone while depressing the push to talk switch and adjust the TUNING control on the R–220/URR for maximum audio in the HS–30–U headset.	*a.* Voice reproduction should be intelligible and free from noise, hum, or buzz.
			b. Release microphone button and set the frequency selector control on MK–430/ART to 126.5. Adjust TUNING control on R–220/URR to indicate 126.5 on tuning dial.	*b.* None.
			c. Repeat *a* above.	*c.* Same as *a* above.
			d. Release microphone button and set the frequency selector control on MK–430/ART to 135.95. Adjust TUNING control on the R–220/URR to indicate 135.95 on tuning dial.	*d.* None.
			e. Repeat *a* above.	*e.* Same as *a* above.
			f. Release microphone button and turn the equipment OFF.	*f.* None.

95. Performance Standard Summary

a. Power output.	20 watts minimum (at all frequencies).
b. Current input.	Not more than 12.5 amperes maximum transmitting.
c. Sidetone.	Not less than 50 milliwatts (with 0.25 volt, 1,000 cps signal input to the modulator).
d. Modulation capability.	90% ±5% (with 0.25 volt at 1,000 cps input to the modulator).
e. Modulation distortion.	10% maximum (with 0.25 volt at 1,000 cps signal input to the modulator).

Section II. FINAL TESTING

96. Purpose of Final Testing

The tests outlined in this section are designed to measure the performance capability of a repaired equipment. Equipment that meets the minimum standards in paragraph 95 will furnish satisfactory operation, equivalent to that of new equipment.

97. Test Equipment Required for Final Testing

The test equipment required for final testing is the same as that listed for fourth echelon testing procedures (par. 86 and 87). Refer to the appropriate technical manuals for instructions on the use of the test equipment. Refer to paragraph 88 for additional information regarding the testing procedures.

98. Final Tests to be Performed

The final tests to be performed on the transmitting set are as follows:

a. Tuning and power output tests (par. 90).

b. Sidetone test (par. 91).

c. Modulation tests (par. 92 and 93).

95. Performance Standard Summary

a. Power output.	20 watts minimum (at all frequencies).
b. Current input.	Not more than 12.5 amperes maximum transmitting.
c. Sidetone.	Not less than 50 milliwatts (with 0.25 volt, 1,000 cps signal input to the modulator).
d. Modulation capability.	90% ±5% (with 0.25 volt at 1,000 cps input to the modulator).
e. Modulation distortion.	10% maximum (with 0.25 volt at 1,000 cps signal input to the modulator).

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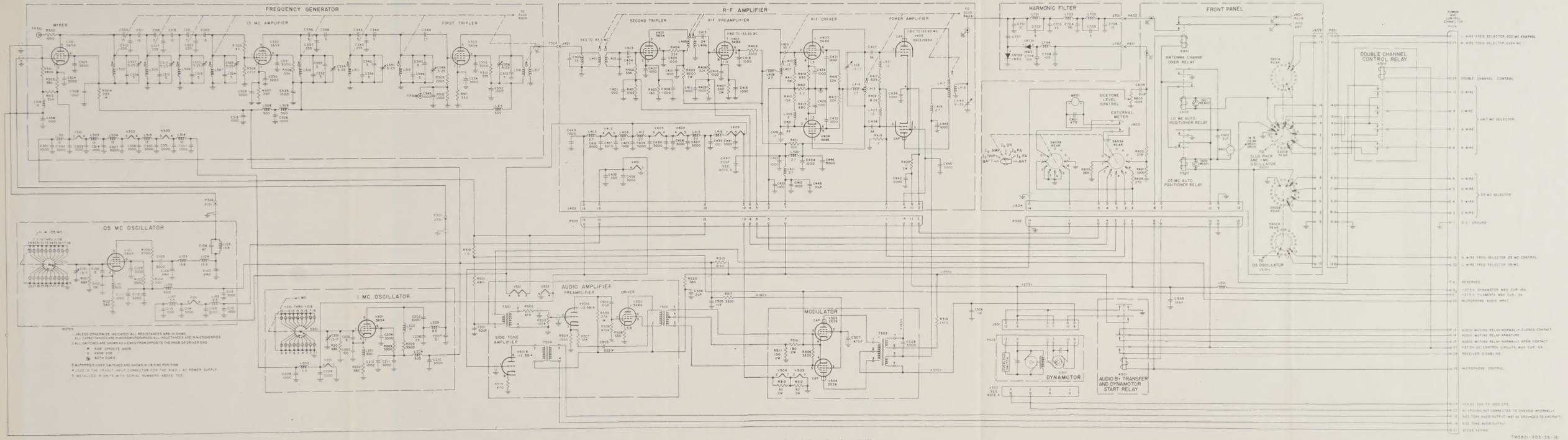

Figure 66. Radio Transmitter T-595/AR, main schematic diagram.

APPENDIX I

REFERENCES

Following is a list of references applicable and available to the field and depot maintenance repairmen of Radio Set AN/ART–34:

TM 11–882	Radio Receiving Sets AN/URR–29 and AN/URR–29X and Radio Receivers R–220/URR and R–644/URR.
TM 11–1036A	Components of Radio Frequency Wattmeter TS–118A/AP.
TM 11–1214A	Oscilloscope OS–8C/U.
TM 11–2050	Test Set I–48–B and Ohmmeter ZM–21A/U.
TM 11–2604	Test Sets I–199 and I–199–A.
TM 11–2635	Q-Meter Boonton Type 160–A.
TM 11–2661	Electron Tube Tests Sets TV–2/U, TV–2A/U, and TV–2B/U.
TM 11–2684*a*	Audio Oscillators TS–382A/U, TS–382B/U, TS–382D/U, and TS–382E/U.
TM 11–5017	Output Meters TS–585A/U, TS–585B/U, TS–585C/U, and TS–585D/U.
TM 11–5030	Signal Generator TS–497A/URR.
TM 11–5083	Electron Tube Test Sets TV–7/U, TV–7A/U, TV–7B/U, and TV–7D/U.
TM 11–5095	Frequency Meter AN/URM–80.
TM 11–5097	Spectrum Analyzers TS–723A/U and TS–723/U.
TM 11–5120	Frequency Meters AN/URM–32 and AN/URM–32A.
TM 11–5126	Power Supply PP–1104A/G.
TM 11–5132	Electronic Voltmeter ME–30B/U and Voltmeter, Meter ME–30A/U.
TM 11–5133	Radio Frequency Wattmeter AN/URM–43A.
TM 11–5527	Multimeters TS–352/U, TS–352A/U, and TS–352B/U.
TM 11–5821–203–12	Operation and Organizational Maintenance: Radio Transmitting Set AN/ART–34.
TM 11–5821–203–12P	Operator's and Organizational Maintenance Repair Parts and Special Tools List for Transmitting Set, Radio AN/ART–34.
TM 11–5821–203–35P	Field and Depot Maintenance Repair Parts and Special Tools List for Transmitting Set, Radio AN/ART–34.
TM 11–6625–202–12	Operation and Organizational Maintenance: Multimeter Meter ME–26B/U.

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11-117
11-155
11-500 (AA-AE)
11-557
11-587
11-592
11-597

NG: State AG (3)

USAR: None

For explanation of abbreviations used, see AR 320–50.

☆ U. S. Government Printing Office: 1960—522585/56